PROCEEDINGS OF THE HELMINTHOLOGICAL SOCIETY OF WASHINGTON

VOLUME 25 JANUARY, 1958 NUMBER 1

Three new digenetic trematodes, *Emoleptalea proteropora*, n. sp., (Cephalogonimidae: Cephalogoniminae), *Phyllodistomum symmetrorchis*, n. sp, and *Phyllodistomum ghanense*, n. sp., (Gorgoderidae: Gorgoderinae) from West African freshwater fishes.

J. D. THOMAS*

Zoology Department, University College of Ghana, Achimota, Accra.

With the exception of the investigations of Szidat (1932), Joyeaux, Gendre and Baer (1928) and Dollfus (1929, 1932) there are only a few scattered references to trematodes of West Africa. Fish trematodes in particular have received little attention, and further information on the taxonomic and geographical affinities of these seem desirable.

The present paper describes trematodes from fishes collected by the writer in the Black Volta river system and the Birim river in the Gold Coast in 1956. One new species of trematode, *Allocreadium voltanum*, has already been described by the writer from this area (Thomas, in press).

The fishes were netted by the staff of the Government Fishery Department. The gills, skin, alimentary canal, urinary bladder and other organs were examined for parasities soon after capture. The trematodes were fixed under slight pressure from a cover slip in corrosive acetate. All measurements, therefore, apply to slightly flattened specimens and are presented in millimeters.

Emoleptalea proteropora, n. sp. (Fig. 1 & 2)

DESCRIPTION: Body short, oval in outline; with a posterior notch; 0.67 to 0.95 long; 0.61 to 0.65 broad at widest point. Body surface, except for cuticular linings of suckers and small region posteriorly, armed with transverse rows of backwardly directed, conical spines; circumoral spines, up to 0.017 long, appreciably longer than spines over rest of body. Oral sucker, almost spherical in shape; 0.125 to 0.155 in diameter; 0.025 to 0.045 from anterior extremity. Ventral sucker in anterior half of body; separated from oral sucker by a distance, equal to, or slightly greater than maximum width of cirrus pouch; 0.15 to 0.18 long; 0.15 to 0.18 broad; slightly larger than oral sucker. Opening of oral sucker ventrally directed; its cavity leading into a very short prepharynx; pharynx pyriform; 0.045 to 0.065 long; 0.050 to 0.065 broad; surrounded by glandular cells; pushed antero-laterally in a few, contracted specimens by cirrus pouch; oesophagus short; gut caeca postero-laterally directed; terminating midway between ventral sucker and posterior testis. Excretory vesicle Y shaped, bifurcating at level of posterior testis; main stem in median line opening ventrally, 0.020 from the posterior end. Genital pore median, on ventral surface of dorsal lip, in front of oral sucker; male and female pores close together in genital atrium. Testes, paired; compact; broadly oval or globular

*The author wishes to acknowledge the kind help of Mr. S. Prudhoe of the British Musuem (Natural History), London, in connection with the examination of records and specimens. Thanks are also due to Professor E. E. Edwards for his interest in the work, to the Fisheries Department in Accra for assistance in obtaining material and to the University College of the Gold Coast for financial aid.

structures; diagonally arranged; immediately behind ventral sucker; 0.10 to 0.12 long; 0.105 to 0.145 broad; intertesticular space absent or roughly equal to length of testes; cirrus pouch S shaped; extending to posterior border of ventral sucker; basal portion with bipartite vesicula seminalis; middle region with pars prostatica; narrow terminal region with ejaculatory duct extending below gut caecum and pharynx before turning dorsally to open into the genital atrium. Ovary pyriform; amphitypic; either to left or

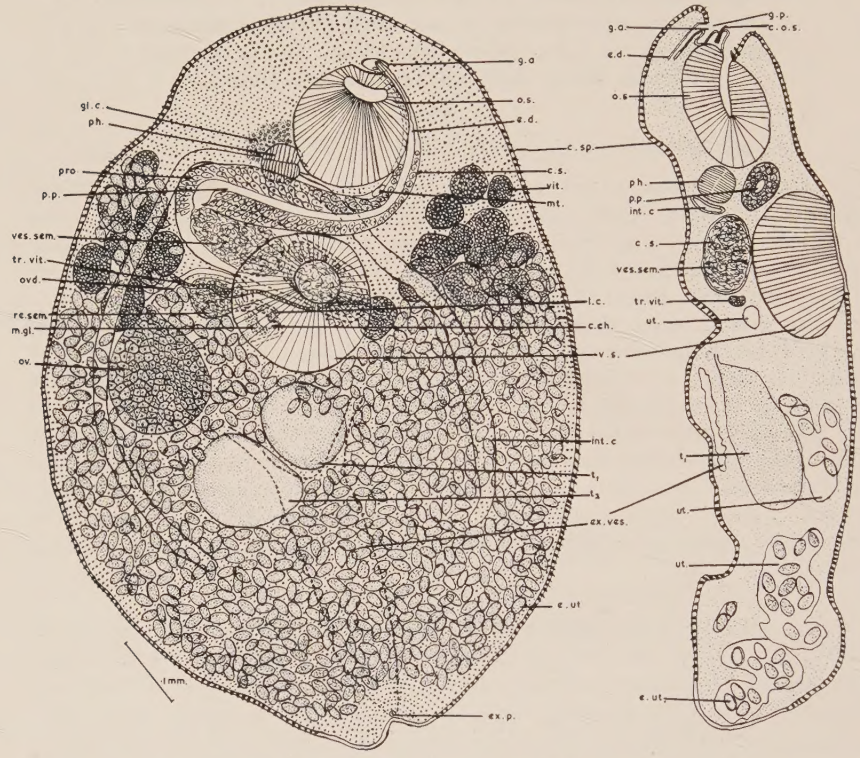


Fig. 1. *Emoleptalea proteropora*, n. sp., ventral view.

Fig. 2. *Emoleptalea proteropora*, n. sp., sagittal section showing position of genital pore.

ABBREVIATIONS

a.l.ex.u.—anterolateral excretory vessel
c. ch.—central chamber of Mehlis's gland
c. o. s.—circum oral spine
c. s.—cirrus sac
c. sp.—cuticular spine
e. d.—ejaculatory duct
e. ut.—eggs in uterus
ex. p.—excretory pore
ex. ves.—excretory vesicle
g.—ganglion
g. a.—genital atrium
g. p.—genital pore
gl. c.—gland cell
int. c.—intestinal caecum
l. c.—Laurer's canal
m. gl.—Mehlis's gland
m. v. d.—median yolk duct
mt.—metraterm
o. s.—oral sucker
oe.—oesophagus
ov.—ovary
ovd.—oviduct
ph.—pharynx
po.—posterior excretory duct
p. p.—pars prostatica
pro.—prostatic cells
re. se.—receptaculum seminis
t.—testis
t_1—anterior testis
t_2—posterior testis
tr. vit.—transverse vitelline duct
ut.—uterus
v. de.—vas deferens
v. ef.—vas efferens
v. s.—ventral sucker
ves. sem.—vesicula seminalis
vit.—vitelline glands
vit. r.—vitelline reservoir

right of ventral sucker, rarely extending behind it; 0.130 to 0.135 long; 0.125 to 0.120 broad; oviduct directed obliquely forward to centre of body, to form the ventrally directed ootype after receiving duct of receptaculum seminis and median vitelline duct dorsally; Mehlis's gland poorly developed. Receptaculum seminis large; globular; behind vesicula seminalis. Laurer's canal arising from receptaculum seminis; directed away from ovary; opening dorsally above margin of ventral sucker. Uterus emerging ventrally from ootype, filling inter and extracaecal space behind ventral sucker not occupied by gonads; also extending marginally beneath vitelline glands in front of ventral sucker; metraterm weakly muscular. Eggs, oval; 0.025 to 0.028 long; 0.016 to 0.020 broad. Vitelline follicles globular; occurring in two groups on either side of ventral sucker; sometimes overlapping it; transverse yolk duct beneath receptaculum seminis, enlarging to form vitelline reservoir, from which median yolk duct arises.

HOST: *Clarias senegalensis* C. & V.

LOCATION IN HOST: intestine.

LOCALITY: Sielo-Tuni stream, a tributary of the Black Volta River near. Wa, Northern Territories of Gold Coast.

TYPES: Holotype in British Museum (Natural History) London.

DISCUSSION: The genus *Leptalea*, erected by Looss (1899) to include *L. exilis*, was placed by him in the family Cephalogonimidae Nicoll, 1913, subfamily Cephalogoniminae Looss, 1899. Looss (1900) subsequently discovered that the genus *Leptalea* was preoccupied and *L. exilis* was placed in the new genus *Emoleptalea*. In addition to *E. exilis* and *E. proteropora*, *E. synodontis* Dollfus, 1950, is the only other species included in the genus *Emoleptalea*. All three species have been recorded from the intestines of freshwater fishes belonging to the suborder Siluroidea in Africa. *E. proteropora* is distinguished from the other two species on the basis of anterior position of the genital pore, short oval outline and the more posterior extent of the cirrus pouch; from *E. exilis* in having the ventral sucker larger than the oral. The genital pore occurs to the left of the middle of the oral sucker in *E. exilis* and in the midline immediately behind the oral sucker in *E. synodontis*. *E. exilis*, therefore, appears to be intermediate between *E. synodontis* and *E. proteropora* in this respect.

Phyllodistomum symmetrorchis, n. sp. (Fig. 3)

DESCRIPTION: Fore body short; subcylindrical; tapering gradually to a broadly oval, dorsoventrally flattened hind body; 4.34 to 4.35 in total length; 2.16 to 2.69 wide at broadest point immediately behind testes. Margin of hind body thickened and distinctly puckered to form sucker-like structures; centre of hind body much folded due to muscular contraction. Oral sucker subterminal; globular; 0.37 to 0.40 long; 0.38 to 0.42 broad. Ventral sucker at junction of fore and hind body; spherical in outline; slightly larger than oral sucker; 0.41 to 0.45 long; 0.41 to 0.43 broad. Buccal cavity leads directly into a short, slender oesophagus; 0.18 to 0.20 long; pharynx absent. Gut bifurcation in anterior quarter of space between oral and ventral sucker; gut caeca inflated; projecting forwards and outwards before extending posteriorly to terminate at 0.25 to 0.71 from posterior extremity. Excretory bladder long; tubular; median; bifurcating behind vitelline glands; opening dorsally 0.020 from posterior extremity. Common genital pore median; ventrally situated, midway between oral and ventral sucker. Testes paired; globular; compact structures; symmetrically situated in anterior half of hind body; almost equal in size; 0.43 to 0.49 long; 0.40 to 0.41 broad; vasa efferentia emerge antero-

dorsally from testes and unite in front of ventral sucker to form a short vas deferens; vesicula seminalis tripartite in front of genital pore; ejaculatory duct ventrally directed, opening into genital atrium; cirrus and cirrus pouch absent. Ovary amphitypic, in front of vitelline glands; near left or right gut caecum; compact globular structure; 0.01 to 0.21 long; 0.14 to 0.18 broad. Oviduct runs obliquely backwards towards mid-body to form ventrally directed central chamber of Mehlis's gland or ootype in front of vitelline glands. Mehlis's gland poorly devleoped. Laurer's canal opens into oviduct dorsally and takes a sinous course postero-laterally, away from ovary, to open dorsally near gut caecum. Median yolk duct received by oviduct after Laurer's canal; vitelline glands lobed; close together; between testes; 0.19 to 0.24 long; 0.10 to 0.15 broad; transverse yolk duct dilated to form vitelline reservoir, which gives rise to median vitelline duct, behind Mehlis's gland. Uterus emerges ventrally from ootype; uterine coils sparsely distributed intra and extracaecally behind gonads. Metraterm above ventral sucker, weakly muscular. Eggs small; oval; 0.022 to 0.024 long; 0.016 to 0.018 broad.

HOST: *Auchenoglanis occidentalis* C. & V.

LOCATION IN HOST: Recorded from the coelom.

LOCALITY: Tributary of Black Volta River near Lawra, Northern Territories of the Gold Coast.

TYPE SPECIMENS: Holotype in British Museum (Natural History), London.

Phyllodistomum ghanense, n. sp. (Fig. 4)

DESCRIPTION: Body spatulate, consisting of broadly oval, dorsoventrally flattened hind body and a short narrow subcylindrical fore body; 3.65 long; 1.50 at widest point near posterior testis. Oral sucker globular; 0.39 by 0.39; ventral sucker larger than oral; 0.50 long; 0.53 broad; ratio of oral to ventral sucker, 1:1.28; two anterolateral and two postero-lateral papillae occur within cavity of ventral sucker. Pharynx absent; oesophagus short; slightly less than diameter of oral sucker in length. Gut bifurcation in anterior third of space between oral and ventral sucker; intestinal caeca, simple; inflated; extending backwards marginally to terminate 0.62 from posterior end. Excretory bladder narrow, bifurcating in median line to form two antero-laterally directed branches which divide midway between gut bifurcation and ventral sucker into anterior and posterior ducts; excretory pore dorsal; 0.02 from the posterior extremity. Two nerve ganglia, joined by a supraoesophageal commissure occur on either side of oesophagus; two anterior, one lateral and one posterior nerves arise from each ganglion. Genital pore behind gut bifurcation, in midline. Testes paired; slightly lobed; diagonally arranged in hind body; anterior testis 0.42 by 0.30; opposite ovary; posterior testis 0.50 by 0.40; behind ovary; slightly larger than anterior testis. Vesicula seminalis bipartite; occupying most of space between gut bifurcation and ventral sucker; ejaculatory duct arising from small ventral chamber of vesicula seminalis directed ventrally into genital atrium; cirrus and cirrus pouch absent. Ovary sinistral; opposite anterior testis and vitelline glands; roughly oval; 0.40 by 0.27; central chamber of Mehlis's gland or ootype placed medially between vitelline glands. Mehlis's gland poorly developed. Receptaculum seminis absent. Uterine coils extensive; filling most of space behind vitelline glands not occupied by gonads, both intra and extracaecally; also extending laterally to posterior level of ventral sucker. Metraterm short; weakly muscular; running from middle of ventral sucker to genital atrium; surrounded distally by glandular cells. Eggs of two sizes; small immature eggs;

0.028 by 0.018; larger eggs with miracidia; 0.032 by 0.018. Vitelline glands roughly oval; obliquely opposed; between anterior margins of ovary and anterior testis; 0.125 to 0.220 behind ventral sucker; 0.27 to 0.33 long; 0.12

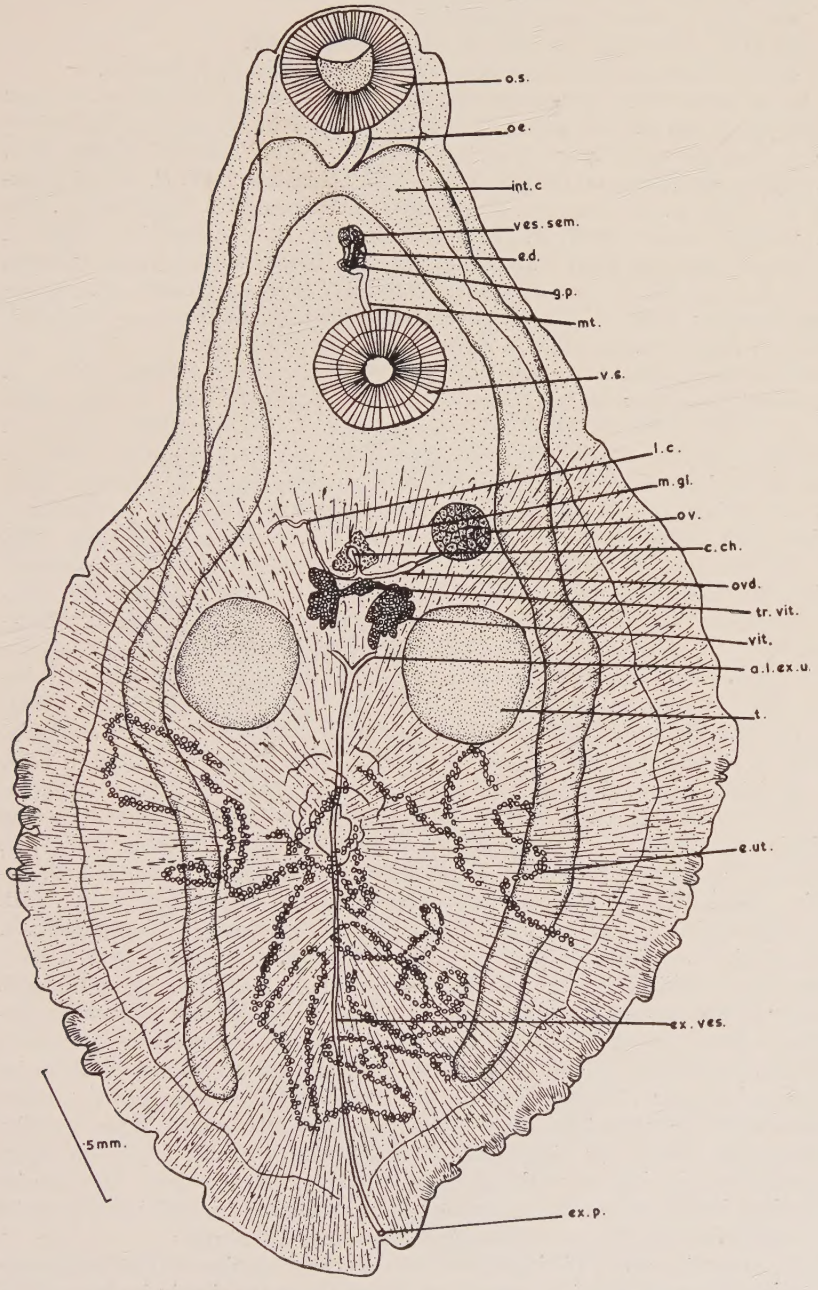


Fig. 3. *Phyllodistomum symmetrorchis*, n. sp., ventral view.

broad; transverse yolk ducts running from inner ventral margins of vitelline glands, enlarging medially to form vitelline reservoir which gives rise to median vitelline duct.

HOST: *Mastacembelus nigromarginatus* Boulenger.

LOCATION IN HOST: urinary bladder.

LOCALITY: River Birim near Abomoso, Gold Coast.

TYPES: Holotype in British Museum (Natural History), London.

COMPARISON WITH OTHER SPECIES: Seventy five species in addition to those described in the present paper have been included in the genus *Phyllodistomum*. They are as follows.—*P. acceptum* Looss, 1901, *P. almorii* Pande, 1937, *P. americanum* Osborne, 1903, *P. angulatum* v. Linstow 1907, *P. baueri* Pigulevsky, 1953, *P. brevicaecum* Steen, 1938, *P. bychowskii* Pigulevsky, 1953, *P. carangis* Manter, 1947, *P. carolini* Holl, 1929, *P. catostomi* Wu, 1938, *P. caudatum* Steelman, 1938, *P. coatneyi* Meserve, 1943, *P. conostomum* (Olsson, 1876) Looss, 1902, *P. cotti* Wu, 1938, *P. dogieli* Pigulevsky, 1953, *P. elongatum* Nybelin; 1926, *P. entercolpium* Holl, 1930, *P. etheostomae* Fischthal, 1942, *P. fausti* Pearse, 1924, *P. folium* (v. Olfers, 1816) Braun, 1899, *P. frequentum* Kaw, 1950, *P. hunteri* (Arnold, 1934), *P. kajika* (Ozaka, 1926), *P. lachancei* Choquette, 1947, *P. lacustri* (Loewen, 1929), *P. leilae* Nagaty, 1956, *P. lesteri* Wu, 1938, *P. lewisi* Srivastava, 1938, *P. linguale* Odhner, 1902, *P. lohrenzi* (Loewen, 1935), *P. loossi* Kaw, 1950, *P. lysteri* Miller, 1940, *P. macrobrachicola* Yamaguti, 1934, *P. macrocotyle* (Lühe, 1909) Odhner, 1911, *P. macronium* (Dayal, 1938), *P. marinum* Layman, 1930, *P. markevitschi Pigulevsky,* 1953, *P. massino* Pigulevsky, 1953, *P. megalorchis* Nybelin, 1926, *P. morgurndae* Yamaguti, 1934, *P. neivai* (Travassos, 1926), *P. nocomis* Fischthal, 1942, *P. notropilus* Fischthal, 1942, *P. orientale* Achmerow, 1941, *P. pacificum* Yamaguti, 1951,*P. parasiluri* Yamaguti, 1934, *P. patellare* (Sturges, 1897), *P. pawlovskii* (Zmeev, 1936), *P. pearsei* Holl, 1929, *P. petruschewskii* Pigulevsky, 1953, *P. pseudaspii* Achmerow, 1941, *P. pseudofolium* Nybelin, 1926; *P. rhyacosiredonis* Bravo, 1943; *P. schistorchis* (Steelman, 1938), *P. semotili* Fischthal, 1942, *P. shandrai* Bhalerao, 1937, *P. simile,* Nybelin, 1926, *P. sinense* Wu, 1937, *P. singhiai* Gupta, 1951, *P. singulare* Lynch, 1936, *P. skrjabini* Pigulevsky, 1953, *P. solidum* Rankin, 1937, *P. spatula* (Odhner, 1902), *P. spatulaeforme* (Odhner, 1902), *P. staffordi* Pearse, 1924, *P. stromi* Pigulevsky, 1953, *P. superbum* Stafford, 1904, *P. tenua* (Rankin, 1937), *P. umbrae* Wu, 1936, *P. undulans* Steen, 1938, *P. unicum,* Odhner, 1902, *P. vachius* Dayal, 1949, *P. vittatusi* Gupta, 1953, *P. wiskowskyi* Pigulevsky, 1953, *P. zachwatkini* Pigulevsky, 1953. Wu (1938) listed three species, namely *P. catastomi, P. cotti* and *P. umbrae* which, as far as the writer is aware, have not been described in the literature and cannot, therefore, be considered. Many of the aforementioned species have been placed in the frequently suppressed genus *Catoptroiles* (Odhner, 1902) by various workers such as Loewen (1929), Byrd et al. (1940) but it is now generally agreed by most authors including Nybeline (1926), Lewis (1935), Bhalero (1937) and Dawes (1946) that *Catoptroides* must fall as a synonym to *hyllodistomum*. More recently, Pigulevsky (1953) has attempted to compromise by subdividing the genus *Phyllodistomum* into several subgenera including *Catoproides*. The species described in the present paper are readily distinguished from all known species of *Phpllodistomum* by the following morphological features:

1. *P. symmetrorchis* is distinguished from all other species of *Phyllodistomum* with the exception of *P. spatula* by having the ovary clearly in front of the vitelline glands and from *P. spatula* by the possession of compact testes.

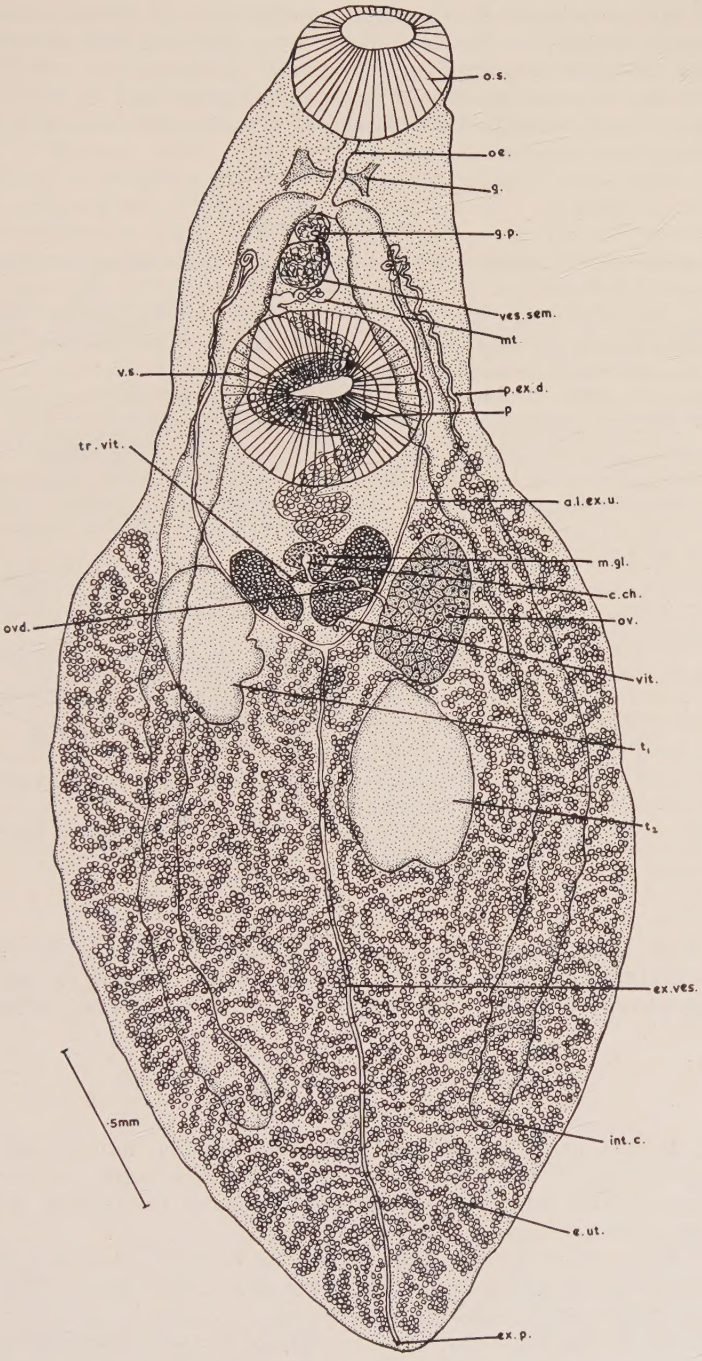


Fig. 4. *Phyllodistomum ghanense*, n. sp., ventral view.

2. *P. ghanense* is distinguished from all other species of *Phyllodistomum* with the exception of *P. spatula, P. spatulaeforme, P. symmetrorchis, P. macronium* and *P. entercolpium* by having vitelline glands between the ovary and anterior testis; from *P. spatula, P. spatulaeforme* and *P. symmetrorchis* in possessing diagonally arranged testes; from *P. entercolpium* in having only slightly lobed testes and from *P. unicum* in having the ventral sucker larger than the oral.

LITERATURE CITED

BHALERO, G. D. 1937. Studies on the helminths of India. Trematoda. IV. Jour. Helminth. 15:97-124.

BYRD, E. E., VERNARD, C. E. and REIBER, R. J. 1940. The excretory system in Trematoda. 1. Studies on the excretory system in the trematode subfamily Gorgoderinae Looss 1899. Jour. Parasit. 26:407-420.

DAWES, *B.* 1946. The Trematoda. Cambridge.

DOLLFUS, R. P. 1929. Helmintha. 1. Trematoda et Acanthocephala. Contribution à la faune du Cameroun, 2e fascicule. Faune Colon. franc. 3:73-114.

———— 1932. Mission Saharienne Augiéras. Draper. Trematodes de Mammiferes oiseaux et poissons. Bull. Mus. Hist. nat. Paris 4:555-563.

JOYEAUX, C., GENDRE, E. and BAER, J. G. 1928. Recherches sur les Helminthes de l'Afrique Occidentale Francaise. Bull. Soc. Path. Exot. 2:9-15.

LEWIS, F. J. 1935. The trematode genus *Phyllodistomum.* Braun. Trans. Amer. micr. Soc. 54:103-117.

LOEWEN, S. L. 1929. A description of the trematode *Catoptroides lacustri* n. sp., with a review of the known species of the genus. Parasitol. 21:55-62.

LOOSS, A. 1899. Weitere Beiträge zur Kenntnis der Trematoden fauna Aegyptens. Zool. Jb. 12:521-784.

———— 1900. Nachträgliche Bemerkungen zur den Namen den von mir vorgeschlagenen Distomidengattungen. Zool. Anz. 23:601-608.

PIGULEVSKY, S. V. 1953. Trematodes of Animals and Man. Basis of Trematodology. 8:253-618. Skrjabin, Moscow. (In Russian.)

SZIDAT, L. 1932. Parasiten aus Liberia und Französich-Guinea. II Teil: Trematoden. Z. Parasitenk. 4:506-521.

WU, K. 1938. Progenesis of *Phyllodistomum lesteri* sp. nov.; (Trematoda: Gorgoderidae) in freshwater shrimps. Parasitol. 30:4-18.

THOMAS, J. D. (1957). A new species of the genus *Allocreadium* (Trematoda: Allocreadiidae) from a freshwater fish, *Alestes macrolepidotus*, in West Africa. Journal of the West African Science Association. 3:1-9.

Two new Digenetic Trematodes, *Heterorchis protopteri*, n. sp. (Fellodistomidae) and *Acanthostomum bagri*, n. sp. (Acanthostomidae: Acanthostominae) from West Africa

J. D. THOMAS

Zoology Department, University of Ghana

Achimota, Ghana

The present paper is the result of an investigation into the trematode parasites of freshwater fishes in Ghana and was prompted by the dearth of knowledge in this field. The present contribution is the third in a series; previous papers include Thomas (1957, 1958).

The fishes examined were obtained from the River Volta or its tributaries and were netted by the Government Fishery Department, Accra. The trematodes were fixed under slight pressure from a cover-glass in corrosive acetate. All measurements, therefore, apply to slightly flattened specimens and are given in mm. Transverse and sagittal sections were cut at 6μ and stained in haematoxylin and eosin.

Heterorchis protopteri, n. sp. (Figs. 1, 2, 3, 4 and 5).

DESCRIPTION: Body oval, tapering gradually at both ends; 1.32 to 3.31 long; 0.67 to 1.15 broad at widest point in region of ventral sucker. Anterior body surface, up to level of ventral sucker, armed with small, backwardly directed spines. Oral sucker; terminal; weakly muscular; 0.16 by 0.22 to 0.31 by 0.38. Ventral sucker in anterior half of body; separated from oral sucker by distance slightly greater than diameter of oral sucker; almost spherical; 0.38 by 0.38 to 0.66 by 0.59; approximately twice as large as oral sucker; ratio of oral to ventral sucker 1:1.85 to 1:2.00. Musculature of body of usual trematode type, extrinsic muscles poorly developed; mesenchyme cells large and vacuolated. Oral opening ventrally situated on posterior quarter of oral sucker; leading into a very short prepharynx; pharynx oval or spherical; 0.12 to 0.17 long; 0.10 to 0.15 broad; surrounded by large glandular cells; oesophagus short, up to 0.08 long; gut caeca posterolaterally directed; terminating at posterior level of excretory pore. Excretory pore dorsal; in posterior third of body; extending from middle of testes to posterior level of gut caeca; excretory bladder conical in form; extending from a short distance behind cirrus pouch to excretory pore; lined by large, vacuolated, columnar cells, with well developed circular muscles; two main excretory ducts anterolaterally directed; lined with short, cuboidal cells; lateral to terminal genital ducts; turning posteriorly at level of pharynx. Genital pore on left lateral margin; midway between oral and ventral sucker. Genital atrium thin walled; elongated; lying a short distance in front of ventral sucker; male and female ducts opening close together at base of atrium. Testes compact; elongated; blunt at anterior end; more pointed posteriorly; almost equal in size; left testis slightly smaller and more anterior than right testis, which occurs behind ovary; 0.35 by 0.12 to 0.78 by 0.22; vasa efferentia arising from antero-dorsal margin of testes, uniting in median line to form short vas-deferens. Cirrus sac large; muscular; extending from anterior level of excretory bladder to genital atrium; basal portion with bipartite vesicula seminalis; middle portion with inconspicuous pars prostatica which is lined inside with cuboidal cells; narrow terminal region with a long, looped, unarmed, ejaculatory duct; cirrus pouch with loosely packed, large, prostatic cells posteriorly, up to the level of pars prostatica and more tightly packed, smaller, deeply staining cells anteriorly; vesicula seminalis, pars prostatica and ejaculatory duct with well developed longitudinal muscles. Ovary; dextral; behind ventral sucker; roughly oval or piriform; compact or lobate; 0.19 by 0.15 to 0.41 by 0.30. Oviduct short, arising dorsally from middle portion of ovary; directed inwardly to form the ootype near ovary; Mehlis's gland surrounding ootype, well developed. Receptaculum seminis large; behind ootype; connected by seminal duct to ootype; seminal duct with swelling dorsally from which a short, sinuous Laurer's canal arises to open dorsally in median field. Uterus, emerging ventrally from ootype, proceeds posteriorly beneath median yolk duct; descending and ascending limbs of uterus fill most of post-ovarian space not occupied by testes and vitelline glands. Metraterm lying parallel and to left of cirrus pouch; almost equal to it in length; circular muscles particularly well developed; cavity lined by secretion of glandular cells. Eggs oval; operculate; 0.025 long; 0.0125 broad. Vitelline follicles numerous; lobed; laterally situated and overlapping gut caeca; extending from posterior third of ventral sucker to posterior level of testes; transverse yolk duct at ovarian level; enlarging to left of receptaculum seminis to form median duct which enters oviduct shortly before formation of ootype.

HOST: *Protopterus annectens* (Owen, 1839).

LOCATION IN HOST: intestine.

LOCALITY: Avedove lagoon, Sogankope, near Volta estuary.

TYPES: Holotype in British Museum (Natural History) London.

DISCUSSION: The genus *Heterorchis,* erected by Baylis 1915, to include *H. crumenifer,* was placed by him in the family Lepodermatidae Odhner, 1911. Dollfus (1950) is of the opinion that Baylis may be correct in allocating it to this family but has reserved his decision on the systematic position of *Heterorchis,* pending the discovery of the cercaria. Travassos (1929), on the other hand, placed *Heterorchis* in the subfamily Reniferinae Pratt and Dollfus (1950) has pointed out that if this view is correct it must be included in the family Reniferidae. Yamaguti (1954) places the genus *Heterorchis* in the family Fellodistomidae.

H. crumenifer, the only species of *Heterorchis* previously described, has been recorded from Lake Victoria, Uganda (Baylis, 1915), from the Cameroons and the Belgian Congo (Dollfus, 1950). According to Baylis (1915) the host fish for his specimens was *Protopterus aethiopicus* Heckel but later he (Baylis, 1934) stated that an error had been made in identification and that the true host was *Clarias mossambicus* or an allied species. Dollfus (1950) has, however, questioned this correction in view of the fact that all subsequent records of *H. crumenifer* have been from *Protopterus* species.

H. protopteri is distinguished from *H. crumenifer* by the possession of a marginal genital pore, a relatively larger ventral sucker, two testes which are nearly equal in size and pointed posteriorly, comparatively small eggs and a receptaculum seminis and transverse vitelline duct situated at mid-ovarian level. In *H. crumenifer* the genital pore is not marginal, the ratio of oral to ventral sucker varies from 1:1 to 1:1.5, the testes are sausage shaped, the right being appreciably larger than the left, the receptaculum seminis and associated structures are postovarian and the eggs are 0.04 in length. The eggs of the specimens examined by Dollfus (1950) were smaller, measuring 0.03 in length, but are appreciably larger than the eggs of *H. protopteri.*

Acanthostomum bagri n. sp. (Fig. 6).

DESCRIPTION: Body elongated; subcylindrical; truncate at anterior end; tapering towards posterior extremity; 1.52 to 2.83 long; 0.44 to 0.62 broad. Body surface armed with spines between anterior extremity and posterior level of vesicula seminalis. Oral sucker subterminal; basin shaped; muscular; 0.26 to 0.35 long; 0.24 to 0.32 broad; with a crown of nineteen, short, backwardly pointing conical spines; 0.5 to 0.6 long; 0.017 to 0.02 broad; arranged in a single circlet outside oral opening. Ventral sucker median; in anterior third of body; 0.11 to 0.13 long; 0.14 to 0.16 broad. Opening of oral cavity leading into prepharynx; 0.05 to 0.18 long; pharynx; large; ovoid; closer to oral than ventral sucker; 0.16 to 0.19 long; 0.10 to 0.17 broad; oesophagus short; bifurcating a short distance in front of ventral sucker; gut caeca posterolaterally directed; opening to outside laterally near posterior extremity. Excretory vesicle Y-shaped; bifurcating behind vesicula seminalis; main stem in median line; pore terminal. Genital atrium median; shallow; a little in front of ventral sucker. Testes; paired; compact; compressed oval; intercaecal; tandem; in posterior region of body; 0.09 to 0.19 from posterior end; almost equal in size; 0.12 to 0.25 by 0.14 to 0.35; intertesticular space narrow or absent. Vasa efferentia; short; arising from

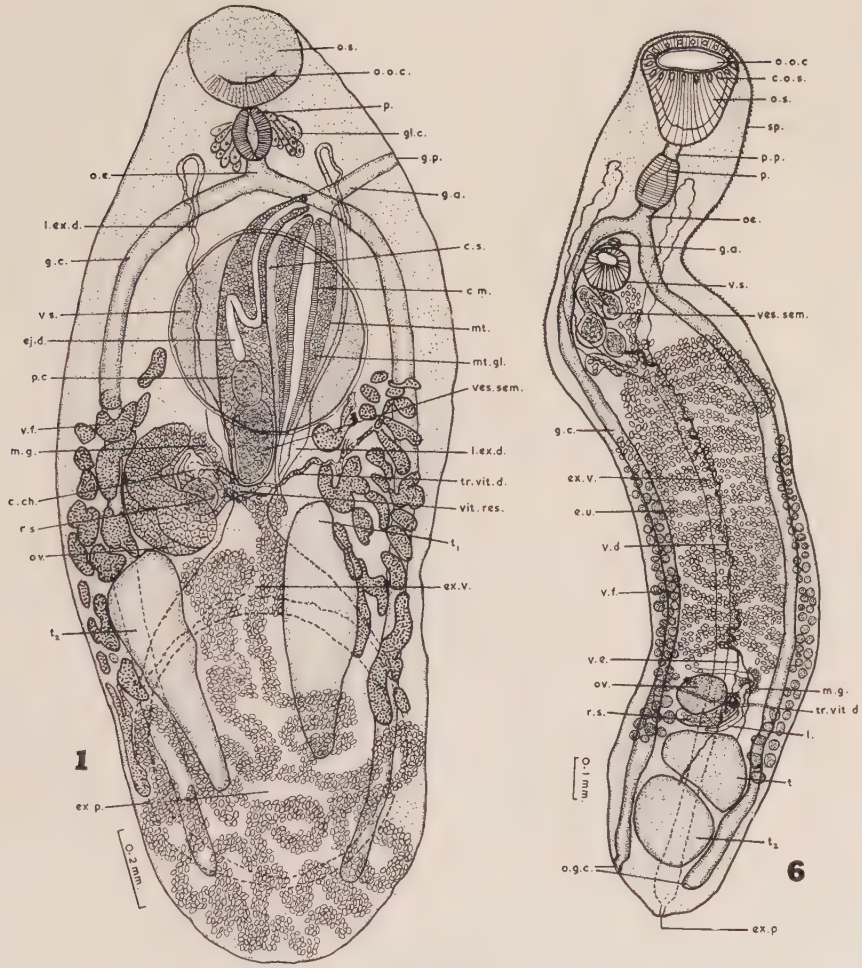


Fig. 1. *Heterorchis protopteri*, n. sp., ventral view.

Fig. 6. *Acanthostomum bagri*, n. sp.; ventral view.

ABBREVIATIONS.

c. ch. central chamber.
c.m. circular muscles.
c.o.s. circumoral spines.
c.s. cirrus sac.
e.u. eggs in uterus
ej.d. ejaculatory duct.
ex.p. excretory pore.
ex.v. excretory vesicle.
g.a. genital atrium.
g.c. gut caecum.
g.p. genital pore.
gl.c. gland cells.
l.c. Laurer's canal.
l.ex.d. lateral excretory duct.
l.m. longitudinal muscle.
M.g. Mehlis' gland.
mt. metraterm.
mt.gl. metraterm gland cells.
o.g.c. openings of gut caeca.
o.o.c. opening of oral cavity.
o.s. oral sucker.
oe. oesophagus.
ov. ovary.
p. pharynx.
p.c. prostatic cells.
p.p. prepharynx.
r.s. receptaculum seminis.
sp. spines.
t. testis.
t_1. testis anterior, t_2. testis posterior.
tr.vit.d. transverse vitelline duct.
v.d. vas-deferens.
v.e. vas efferens.
v.f. vitelline follicles.
v.s. ventral sucker.
ves.sem. vesicula seminalis.
vis.res. vitelline reservoir.

antero-dorsal margin of testes; uniting in median line to form a long, sinuous vas deferens. Vesicula seminalis large; much coiled; behind ventral sucker; sperm duct undifferentiated; joining metraterm dorsally to form short, muscular, hermaphrodite duct; prostatic cells present outside hermaphrodite duct. Ovary spherical or oval; 0.10 by 0.15 to 0.15 by 0.14; pretesticular; its posterior margin overlapping receptaculum seminis which lies between ovary and anterior testis. Oviduct short; arising from inner dorsal surface of ovary; directed to left of ovary to form ootype after receiving short duct from receptaculum seminis and median vitelline duct; Mehlis's gland poorly developed. Laurer's canal short; arising from oviduct near point of entry of receptaculum seminis; directed posteriorly behind receptaculum seminis to open dorsally in median field. Uterus emerging ventrally from ootype; occupying most of intercaecal space in front of gonads as far forward as vesicula seminalis; distal part of uterus weakly muscular. Eggs operculate; oval; 0.035 to 0.040 long; 0.015 broad. Vitelline follicles numerous; in two lateral groups along margin of body; extending from intertesticular region to mid-body; transverse yolk duct beneath ovary and anterior portion of receptaculum seminis; enlarging to form vitelline reservoir from which median yolk duct arises.

Host: *Bagrus docmac* (Forskal).

Location in host: intestine.

Locality: Tributary of River Volta, near Lawra, Northern Region of Ghana.

Types: Holotype in British Museum (Natural History) London.

Discussion: The genus *Acanthostomum,* erected by Looss (1899) to include *A. spiniceps* (Looss, 1896), was placed in the family Acanthostomatidae by Poche (1926) and in the subfamily Acanthostomatinae by Nicoll (1914). Twenty-one species in addition to *A. bagri* have been included in the genus *Acanthostomum.* They are as follows: *A. absconditum* (Looss, 1901), *A. atae* Tubangui et Masilungan, 1936. *A. burminis* (Bhalerao, 1926), *A. caballeroi** Pelarez y Cruz, 1953, *A. coronarium* (Cobbold, 1861), *A. crocodili* Yamaguti, 1954, *A. diploporum* (Stunkard, 1931), *A. elongatum* Tubangui et Masilungan, 1936, *A. gnerii* Szidat, 1954, *A. gonotyl* (Dollfus, 1950), *A. gymnarchi* (Dollfus, 1950), *A. imbutiforme* (Molin, 1859), *A. indicum* Sinha, 1942, *A. marajoarum* (de Freitas et Lent, 1938), *A. minimum* Stunkard, 1938, *A, praeterium* (Looss, 1901), *A. productum* (Odhner, 1902), *A. quasitum* (Nicoll, 1918) sp. inquir., *A. scyphocephalum* (Braun, 1901), *A. spiniceps* (Looss, 1896) Looss 1899, *A. vicinum* (Odhner, 1902).

One of the above species, namely, *A. quasitum,* is a species inquirenda and there have been attempts at removing certain other species to newly erected genera. Thus Bhalerao (1940) transferred *A. burminis* (Bhalerao, 1926) to the genus *Atrophecaecum* on the basis of the much reduced size of one of the gut caeca. This distinction was disregarded by Dollfus (1950) and he included *A. burminis* in the genus *Acanthochasmus* Looss, 1901 (= *Acanthostomum,* Looss, 1899). Morosov (1955), on the other hand, has included two other species, namely *A. diploporum* (Stunkard, 1931) and *A. minimum* Stunkard, 1938, in the genus *Atrophecaecum* and has also erected another genus *Gymnatrema,* to include *A. gymnarchi* (Dollfus, 1950) in view of the fact that the vitelline glands extend to the posterior extremity in this

*Neither the type material nor detailed description of this form was available for study.

species. It is doubtful whether the differences described by Bhalerao (1940) and Morosov (1955) justify generic separation and in the present paper the species concerned are retained in the genus *Acanthostomum*. *A. bagri* can be distinguished from all known *Acanthostomum* species by a consideration of the following morphological features:

In possessing fewer than twenty circumoral spines it differs from all other species with the exception of *A. absconditum, A. imbutiforme, A. minimum* and *A. praeterium;* in having a pharynx appreciably larger than the vental sucker it differs from all other species with the exception of *A. atae, A. burminis, A. coronarium, A. crocodili, A. diploporum, A. gnerii, A. gymnarchi, A. marajoarum, A. minimum* and *A. scyphocephalum.*

ACKNOWLEDGMENTS

The writer is indebted to the Government Fishery Department, Accra, for netting the fish, to the University College of Ghana for financial aid, to Mr. S. Prudhoe of the British Museum for assistance in the examination of records and to Mr. K. Ainoo for cutting sections of the trematodes.

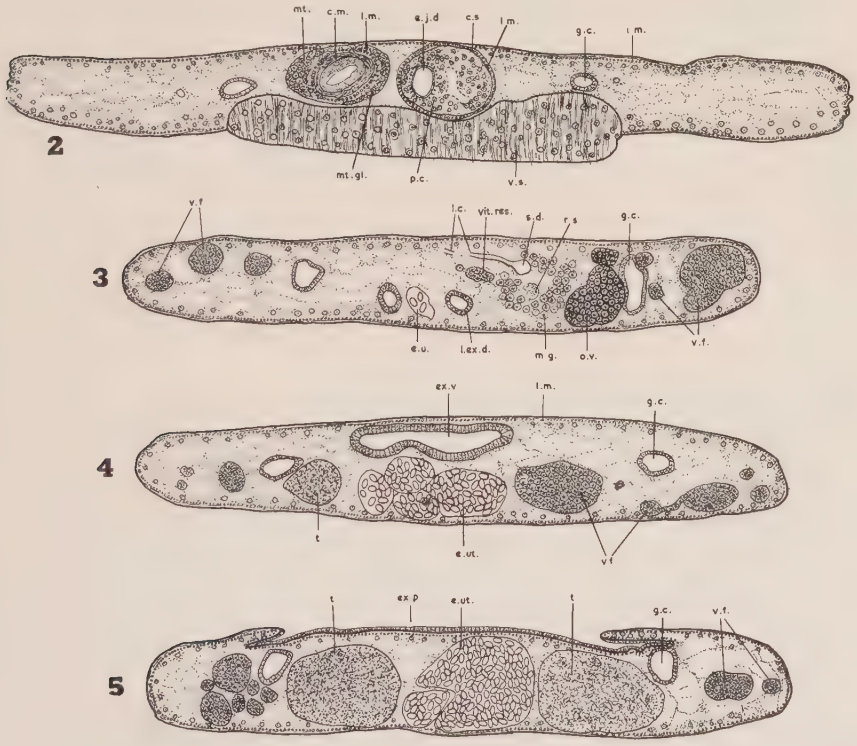


Fig. 2. Transverse section through the ventral sucker of *H. protopteri*, showing cirrus pouch and metaterm.

Fig. 3. Transverse section through the ovary of *H. protopteri* showing Laurer's canal and Mehlis' gland.

Fig. 4. Transverse section through the excretory vesicle of *H. protopteri.*

Fig. 5. Transverse section through the excretory pore of *H. protopteri.*

Literature Cited

Bhalerao, G. D. 1940. Observations on the anatomy of *Acanthostomum burminis* (Bhalerao, 1926). Indian J. Vet. Sci. 10: 94-97.

Baylis, H. A. 1915. A trematode from *Protopterus*. Ann. Mag. Nat. Hist. (8) 16: 85-96.

———. 1934. Three Helminthological Notes. Ann. Mag. Nat. Hist. (10) 14: 115-121.

Dollfus, R. P. 1950. Trématodes récoltés au Congo Belge par le Professeur Paul Brien (mai-août 1937). Ann. Mus. Congo Belge. 8vo. Ser. V. 1 (1): 1-133.

Looss, A. 1899. Weitere Beiträge zur Kenntnis der Trematoden-Fauna Aegyptens. Zool. Jber. 12: 521-784.

Morosov, H. 1955. Trematodes of Animals and Man. Basis of Trematodology. 10: 243-335. Skrjabin, Moscow. (In Russian.)

Nicoll, W. 1914. The Trematode Parasites of Fishes from the English Channel. J. Mar. Biol. Assn. U. K. 10: 466-505.

Poche, D. 1926. Das System der Platodaria. Arch. Naturgesch. 91 (A): 1-458.

Thomas, J. D. 1957. A new species of the genus *Allocreadium* (Trematoda: Allocreadiidae) from a freshwater fish, *Alestes macrolepidotus* in West Africa. J. W. Afr. Sci. Assn. 3:1-9.

———. 1958. Three new digenetic trematodes, *Emoleptalea proteropora*, sp. nov.; (Cephalogonimidae: Cephalogoniminae), *Phyllodistomum symmetrorchis*, sp. nov., and *Phyllodistomum ghanense* sp. nov., (Gorgoderidae: Gorgoderinae) from West African fresh water fishes. Proc. Helm. Soc. Wash. 25: 1-8.

Travassos, L. 1929. Faune helminthologique du Matto Grosso (Trématodes, 1 part). Mem. Inst. Osw. Cruz. 21: 309-372.

Yamaguti, Satyu. 1954. Systema helminthum. Part 1. Digenetic trematodes of fishes. 405 pp., Tokyo.

Tetracotyle lepomensis, n. sp., (Trematoda: Strigeidae) from Fresh-water Fish in Albemarle County, Virginia

Burton J. Bogitsh*

One hundred and twenty specimens of *Lepomis macrochirus macrochirus* Raf. and *L. gibbosus L.* were examined from several private ponds in Albemarle County, Virginia. Forty-three of these fish were found to harbor the cysts of a larval strigeid. It was determined that the forms were of the genus *Tetracotyle* de Filippi, 1855, and because they could not be placed in any existing species, they are herein described as a new species and assigned the species name *lepomensis,* after the hosts in which they were found.

The small cysts were found in grape-like clusters attached to the dorsal mesentery within the body cavity of the host. The maximum number of cysts recovered from a single fish-host did not exceed 20. The worms were tightly enclosed within the cyst and showed little movement. The cysts were difficult to open mechanically; however, immersion in 0.85% saline for 24 hours facilitated this operation. The specimens were fixed in hot Bouin's, stained with Harris' hematoxylin and mounted in balsam. Sectioned material was stained

*From the Department of Biology, University of Virginia, Charlottesville, Virginia. Present address: Department of Biology, Georgia Teachers College, Collegeboro, Georgia.

with Mallory's triple stain. The following measurements, stated in millimeters, were taken from 5 mounted specimens.

Tetracotyle lepomensis, n. sp.

CYST: Oval cyst, measuring 0.49 (max. 0.50, min. 0.47) in length by 0.31 (max. 0.32, min. 0.308) in width. Cyst wall composed of 2 portions, an inner, lamellated portion, gelatinous in texture, measuring 0.046 (max. 0.056, min. 0.033) in thickness, an outer connective tissue portion measuring 0.009 (max. 0.010, min. 0.008) in thickness. Cysts attached to mesenteries by stalks of connective tissue.

PARASITE: Spinose body divided into fore- and hind-regions. Former 0.383 (max. 0.442, min. 0.314) long by 0.249 (max. 0.267, min. 0.231) wide; latter 0.151 (max. 0.168, min. 0.122) long by 0.097 (max. 0.102, min. 0.089) wide. Oral sucker ventral and subterminal measuring 0.073 (max. 0.089, min. 0.066) long by 0.077 (max. 0.102, min. 0.056) wide. Sub-ventral mouth opening directly into a dorsal, muscular pharynx. Pharynx measures 0.033 (max. 0.036, min. 0.029) long by 0.026 (max. 0.033, min. 0.023) wide. Short, slender esophagus bifurcates into 2 intestinal caeca, running posteriorly to hind-body. Prominent ventral suctorial pocket, opening anterior to acetabulum. Acetabulum ventral, muscular, usually closed in fixation, measures 0.095 (max. 0.116, min. 0.076) long by 0.094 (max. 0.116, min. 0.066) wide. Hold-fast organ posterior to acetabulum, trilobed, 2 anterior and 1 posterior. Lobes, when protruded, project anteriorly, ventral to acetabulum. Hold-fast organ measures 0.145 (max. 0.175 min. 0.099) long by 0.157 (max. 0.165, min. 0.149) wide. Hold-fast gland, when perceivable, posterior to organ. Rudiments of reproductive system confined to hind-body and appear as darkly staining masses. Lateral cotylae never everted, measure 0.072 (max. 0.083, min. 0.066) in length.

TYPE HOST: *Lepomis gibbosus* L. (also found in *L. m. macochirus* Raf.)

TYPE LOCALITY: Albemarle County, Virginia.

TYPE SPECIMEN: U. S. N. M. Helm. Coll. No. 38248.

DISCUSSION

The present specimens appear to bear little likeness to the tetracotyliform parasites hitherto reported from fish. Hughes (1928) has described 3 species and has given a comparative synopsis of the other species that are known to parasitize fish. *T. lepomensis* differs from all other forms of *Tetracotyle* described from fish in that it exhibits a well-defined hind-body and has a well-developed suctorial pocket. Hughes states: "In general, the so-called 'suctorial pocket' . . . is very shallow or wanting in those tetracotyles which have been described from fishes." *T. lepomensis* further differs from *T. communis* Hughes, 1928, in that it possesses a prominent, muscular pharynx and also in the nature of the cyst (delicate in *T. communis*). In addition, it differs from *T. diminuta* Hughes, 1928, and *T. intermedia* Hughes, 1928, in its overall larger size, the position of the muscular pharynx (posterior to oral sucker in the above forms) and its location in the fish-host. Because *T. tahoensis* Haderlies, 1953, closely resembles *T. communis* except in ". . . the relative size and shape of the lateral cotylae (Haderlie, 1953)," further comparison between the former and *T. lepomensis* is not necessary. Hunter (1942) has described a cyst of a tetracotyliform parasite recovered from fish collected in Connecticut. Hunter referred to this cyst as "the sand grain grub." There is a marked similarity between the cyst of the aforementioned parasite and that of *T. lepomensis*.

Hughes (1929, a,b) has compiled synopses of tetracotyles that infect invertebrates and vertebrates other than fish. A comparative study reveals that *T. lepomensis* most closely resembles *T. serpentis* Hughes, 1929, a parasite of reptiles, and *T. pipientis* Faust, 1918, a parasite of frogs, but differs from these forms in the nature of the cyst, the overall size of the parasite and the possession of a well-defined hind-body.

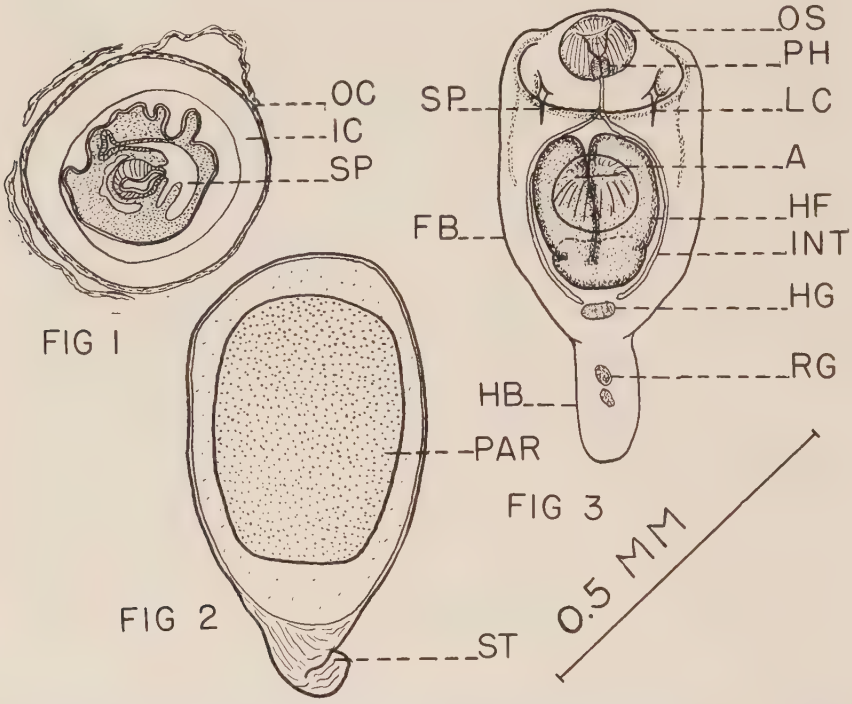


Figure 1. Cross-section of cyst of *Tetracotyle lepomensis* n. sp. IC, inner cyst wall; OC, outer cyst wall; SP, suctorial pocket.

Figure 2. Cyst of *T. lepomensis* n. sp. mounted *in toto*. PAR, parasite; ST, stalk.

Figure 3. *T. lepomensis* n. sp., ventral view of metacercaria. A, acetabulum; FB, fore-body; HB, hind-body; HF, hold-fast organ; HG, hold-fast gland; INT, intestine; LC, lateral sucker; OS, oral sucker; PH, pharynx; RG, rudiments of gonads; SP, suctorial pocket.

Literature Cited

Haderlie, E. C. 1953. Parasites of the fresh-water fishes of northern California. Univ. Calif. Publ. Zool. 57(5):303-440.

Hughes, R. C. 1928. Studies on the trematode family Strigeidae (Holostomidae) No. XIII. Three species of tetracotyle. Trans. Amer. Micr. Soc. 47(4):414-433.

————, 1929a. Studies on the trematode family Strigeidae (Holostomidae) No. XVII *Tetracotyle flabelliformis* Faust. Papers Mich. Acad. Sci., Arts and Letters. 10:495-508.

————. 1929b. Studies on the trematode family Strigeidae (Holostomidae) No. XVIII. *Tetracotyle serpentis* sp. nov. Trans. Amer. Micr. Soc. 48(1): 12-19.

Hunter, G. W., III. 1942. Studies on the parasites of fresh-water fishes of Connecticut. State. Geol. and Nat. Hist. Survey. Bull. #63:228-288.

Dolichodorus similis, (Dolichodorinae), a new species of plant nematode

A. MORGAN GOLDEN*

The genus *Dolichodorus* was established by Cobb in 1914 when he described *D. heterocephalus,* a species obtained from fresh water at Douglas Lake, Michigan, and Silver Springs, Florida. For many years no other species was added to the genus, but that lone species has received considerable attention in recent years because of its recognized importance as an ectoparasite on celery, sweet corn, and certain other plants, primarily in the southeastern United States (Christie, 1952, 1953; Perry, 1953; Tarjan, et al, 1952).

A new species from California was recently described by Allen (1957) as *D. obtusus.* Another new species of *Dolichodorus* from the same state is described herein. This latter species was obtained in small numbers from moist sail collected around the roots of *Sparganium greenei* Morong. a few miles from Monterey Bay. It is presumed that the nematode was feeding upon the roots of this plant, but no information has yet been obtained as to its hosts, distribution, and possible role as a plant pathogen. This species resembles *D. heterocephalus* in many respects, but differs from it in certain morphological characters.

Dolichodorus similis, n. sp.

MEASUREMENTS:

Average of 10 females—Length 2.97 mm (2.94–3.16); a = 51.2; b = 12.3; c = 33.0; V = 55%

Average of 3 males—Length 2.35 mm (2.20–2.52); a = 46.0; b = 11.2; c= 60.2

FEMALE: Body cylindrical, elongate, and usually lying straight when molting or dead. Lip region prominent, markedly offset from body and bearing about 8 very fine annules (exact number difficult to determine); small anterior protuberance on or of lips at oral opening. Annulation on body cuticle very distinct but fine, the annules measuring approximately 1.2 microns each. Deirids not seen. Lateral field a little more than 1/5 body width and occurring clearly as 3 lines (fig. 1-D) only on certain portions of the body, usually anterior to the vulva. The center line begins at about the middle of the unprotruded stylet, extends as a distinct line on the body to the vicinity of the anus where it becomes uneven and faint, ending on tail generally as shown in fig. 1-C. The two outer lines, regularly interrupted when present by the transverse body striae and thereby forming an aerolated lateral field, begin slightly posterior to the basal bulb, become less distinct in area of vulva, and disappear entirely between vulva and anus. Phasmids opposite each other and seen as small dots located on tail almost half the distance from anus to tail tip. Tail, measuring 90 microns (78-99), conically tapering to a long median point and, although variations occur, generally appearing as shown in fig. 1-C.

Anterior portion as presented in fig. 1-B. Cephalic framework rather dense with strong basal plate. Stylet long, awl-shaped, measuring 84 microns (79-87); stylet knobs distinct, relatively small, sloping posteriorly. Opening of dorsal esophageal gland 7 microns from base of stylet. Median bulb usu-

*Nematologist, Crops Research, Division, Agricultural Research Service, U. S. Department of Agriculture, Salinas, Calif.

ally shaped as shown, rather large, being slightly more than half the body width at that point; valvular apparatus well-developed and particularly in lateral view, generally appears to be pointed at an off-center angle from an anterior-posterior center line of the body. Isthmus short, encircled at its posterior portion by the nerve ring, the latter being only slightly anterior to the basal bulb. Esophageal glands forming a somewhat clavate basal bulb at the base of which is the intestine. The cells of the latter usually filled with globular granules of varying size. Excretory pore opening posterior to nerve ring and generally situated at a level approximately at the middle of the basal bulb.

Vulva a transverse slit located slightly posterior to the middle of the body. Vagina with well-developed cuticular lining extending inward to almost half the body width at that point. From it, one uterus leads anteriorly and one posteriorly, each ending in a prominent, somewhat oval seminal receptacle. Ovaries, two, opposed, outstretched. Oocytes in single file except in a rather long region of multiplication where they seem to be in as many as four rows. No eggs subitable for measurement were observed.

Male: Smaller than females in overall size but similar in anterior portion of body (fig. 1-B: female), including its head shape, head and body annulation, location of excretory pore, and absence of evident deirids. Lateral field about 1/4 of body width; consisting of 3 lines beginning anteriorly approximately as described for female and extending, aerolated, to the posterior portion of the body. Then the two outer lines fade out just before reaching the anterior part of the spicules (fig. 1-A) while the center line continues until it reaches the vicinity of the middle of the spicules. Stylet 81 microns (80-84); stylet knobs as in female. Opening of dorsal esophageal gland 7 microns from base of stylet. Bursa extensive, tri-lobed; the large right and left lobes separated from dorsal piece for a short distance posteriorly (fig. 1-A). The small phasmids are located on the inner lobe about half the distance from anus to tail tip. Testis, single, outstretched, ending slightly anterior to middle of body. Seminal vesicle containing apparently globular sperm. Slightly curved spicules measure 58 microns (57-59). Gubernaculum 23 microns in length.

Diagnosis: *Dolichodorus* differing from other described species in its (1) relatively short stylet (female 84 microns and male 81 microns compared with more than 100 microns in both males and females of other known species); (2) location of excretory pore (posterior to nerve ring and at a level with middle of basal bulb, while in *D. heterocephalus* it is anterior to nerve ring); and (3) female tail tapering conically to a long, median point (*D. heterocephalus* is similar, but *D. obtusus* has an obtusely rounded tail).

Holotype—Female: Material collected by author July 1956. Vial No. 101 (TAF fixative), Type Collection of Nematology Section, U. S. Department of Agriculture, Beltsville, Maryland.

Allotype—Male: Same collector and date as for holotype. Vial No. 102 (TAF fixative), Type Collection of Nematology Section, U. S. Department of Agriculture, Beltsville, Maryland.

Paratypes—Males and females: Type Collection of Nematology Section, U. S. Department of Agriculture, Beltsville, Maryland; and University of California Nematode Survey Collection, Berkeley, California.

Type habitat, host, and locality—Moist soil around the roots of *Sparganium greenei* Morong. (Greene's bur-reed) growing along the edge of the Pajaro river at Watsonville, California.

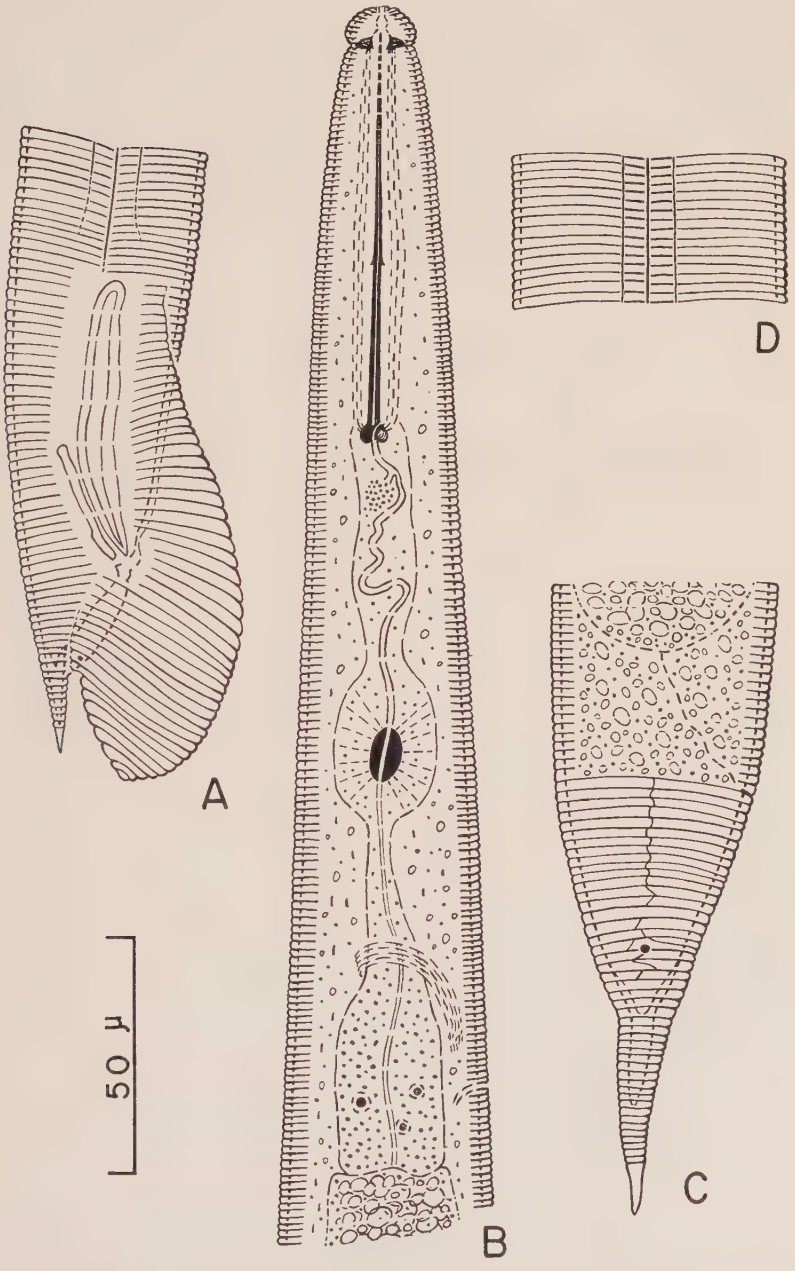


Figure 1. *Dolichodorus similis*, n. sp. A. Posterior portion of male in lateral view. B. Anterior portion of female. C. Posterior portion of female. D. Lateral field as usually found on female slightly anterior to vulva.

Literature Cited

Allen, M. W. 1957. A new species of the genus *Dolichodorus* from California (Nematoda: Tylenchida). Proc. Helminth. Soc. Wash. 24:95-98.
Christie, J. R. 1952. Some new nematodes of critical importance to Florida growers. Proc. Soil Sci. Soc. Florida. 12:30-39.
Cobb, N. A. 1914. North American free-living fresh-water nematodes. Trans. Amer. Micros. Soc. 33:35-99.
———. 1953. Ectoparasitic nematodes of plants. Phytopath. 43:295-297.
Perry, V. G. 1953. The awl nematode, *Dolichodorus heterocephalus*, a devastating plant parasite. Proc. Helminth. Soc. Wash. 20:22-27.
Tarjan, A. C., B. F. Lownsbery, and W. D. Hawley. 1952. Pathogenicity of some plant-parasitic nematodes from Florida soils. I. The effect of *Dolichodorus heterocephalus* Cobb on celery. Phytopath. 42:131-132.

A New Genus, *Pseudhalenchus* (Tylenchinae: Nematoda), With Descriptions of Two New Species*

A. C. Tarjan

Citrus Experiment Station

University of Florida

Populations of animals that strikingly resemble several known genera, but that are difficult to assign to any one, often come to the attention of investigators. Such a case was encountered recently with terrestrial nematodes that appeared closely related to the genera *Halenchus* Cobb, 1933, *Ditylenchus* Filipjev, 1934, and *Tylenchus* Bastian, 1865. A superficial examination revealed nematodes of a phlegmatic nature, resembling *Ditylenchus*. More critical studies of preserved specimens showed the animals also to resemble *Tylenchus*, but to differ mainly in the position of the esophageal glands which lie free in the body, overlapping part of the intestine, while in *Tylenchus* and *Ditylenchus* the glands are inclosed in a bulb. Several morphological and anatomical characteristics of these specimens indicated, however, that they were most closely related to *Halenchus fucicola* (de Man and Barton in de Man, 1892) Cobb, 1933, a marine species. An examination of the descriptions and figures of *H. fucicola* as well as the other species believed to be in the genus has necessitated an emendation of the generic description of *Halenchus*.** Because of the relationship of the characters of the two new species involved with those of *H. fucicola*, the type species of the genus *Halenchus*, the nomen *Pseudhalenchus* n. gen. is proposed for their reception.

Pseudhalenchus, n. gen.

Description: *Tylenchinae*. Both sexes similar in appearance. Somatic annulation light to moderately heavy. Lip region annulation moderate to indistinct. Labial framework sclerotized. Stomatostyle well developed, usually with distinct knobs. Deirid (cervical papilla) observed on some specimens.

*Florida Agricultural Experiment Station Journal Series, No. 635.
**An emended description of the marine nematode genus *Halenchus Cobb*, 1933 (Tylenchinae). Quar. Jour. Fla. Acad. Sci. (in press).

Metacorpus bulb of esophagus valvate with distinct outline. Esophageal glands overlapping intestine. Ovary monodelphic and prodelphic. Vulva situated in posterior third of body. Rudimentary posterior uterus present. Male with well defined spicules and gubernaculum, with bursa (caudal alae) enveloping one-third to two-thirds of tail. Lateral fields present, phasmids not observed in either lateral or dorso-ventral view. Tail of both sexes elongate-conoid, tapering, with minutely-rounded to broadly-rounded terminus.

DIAGNOSIS: Genus differing from the most closely related genus *Halenchus Cobb,* 1933, in the absence of a consistently ventrally-hooked tail, the presence of a well-defined metacorpus with valves, and by its terrestrial habitat as opposed to the marine habitat of *Halenchus.* Differing from both *Ditylenchus* Filipjev, 1934, and *Tylenchus* Bastian, 1865, in its esophagus, the basal portion of which overlaps the anterior portion of the intestine as opposed to the distinct basal esophageal bulb formed by the two aforementioned genera.

The name *"Pseudhalenchus"* connotes "false *Halenchus.*" It is of Greek derivation and consists of *"pseudes"* meaning false, *"halos"* meaning sea, and *"enchos"* meaning spear.

TYPE SPECIES: *Pseudhalenchus minutus,* n. gen., n. sp.

Pseudhalenchus minutus, n. sp. (Fig. 1 A-K)

MEASUREMENTS: 12 females: L = 0.412 mm. (0.348-0.486 mm.); a = 29.7 (28.5-31.7); b = 3.3 (3.0-3.6)‡; c = 8.3 (7.6-9.9); V = ^{30}73 (72-74 percent. 7 males: L = 0.332 mm. (0.309-0.365 mm.); a = 32.5 (30.9-34.2); b = 3.1 (2.9-3.3)‡; c = 7.9 (7.5-8.3); T = 32 percent (28-35 percent).

Body assuming a slightly ventrally arcuate position when killed by gradual heat. Annulation moderate, becoming coarser in caudal region (Fig. 1, K). Lip region set off slightly, bearing 5 annules and terminating in lightly sclerotized labial framework (Fig. 1, B). Female stylet 8.5 (6.9-10.1) microns long; male stylet 8.2 (7.8-8.4) microns long, usually somewhat thinner than female stylet. Knobs on stylet inclined posteriorly. Orifice of dorsal esophageal gland about 2-3 microns behind stylet base. Hemizonid readily apparent, 2 annules long, immediately anterior to excretory pore, appearing to transversely overlap 1/3 of the body circumference. Excretory pore situated 63 (56-71) microns from anterior end. Esophagus expanding to form elongate, weakly muscular metacorpus with a sclerotized valvular apparatus. Isthmus of esophagus narrow, encircled by nerve ring. Posterior portion of esophagus often exhibiting gland nuclei (Fig. 1, A), overlapping intestine. Ovary monodelphic and prodelphic, outstretched; spermatoza present in receptaculum seminis (spermatheca) of female. Vulva transverse, rarely protruding. Rudimentary posterior uterus about 2/3 as long as width of corresponding body diameter (Fig. 1, E), actually measuring 6.4 (5.3-7.7) microns. Testis of male outstretched. Spicules arcuate, 12.9 (11.9-13.8) microns long, cephalated proximally. Gubernaculum 3.3 (3.0-3.7) microns long, with slight flexure (Fig. 1, D). Bursa (caudal alae) beginning anteriorly in region of spicule cephalation, terminating at about 1/3 the tail length. Tails of both sexes tapering uniformly, ventrally inclined near the minutely rounded terminus (Fig. 1, C). Female tail somewhat variable in shape (Fig. 1, C, G, H, I, and J). Deirids (cervical papillae) observed on some specimens. Lateral alae appear as four lines (Fig. 1, F) which become

‡ Esophageal length includes glands.

indistinct in caudal region (Fig. 1, K). Phasmids not observed in either lateral or ventral views.

Holotype: Female collected by the author March 2, 1956. Slide 1, Tray 1, Cabinet C-2724, Nematode Collection, Citrus Experiment Station, Lake Alfred, Florida.

Paratypes: One male, Slide 2, Tray 1, Cabinet C-2724, Nematode Collection, Citrus Experiment Station, Lake Alfred. One female and male, slides 106 and 107 respectively, University of California Collection, Berkeley. One male, three females, and one larva in author's possession.

Type Habitat: Soil and organic debris obtained from tracks of a bulldozer eradicating citrus trees.

Type Locality: Citrus grove owned by Waverly Growers' Cooperative, North of Star Lake, Lake-of-the-Hills, Florida.

Other Hosts and Localities: Nine females, 3 males, and 3 larvae from *Podocarpus* sp, roots and soil, Lynn McNeer Nursery, Okahumpka, Florida, collected by R. F. Suit, October 20, 1956. Two females from tracks of a bulldozer eradicating citrus trees, Estes Grove, Alturas, Florida, collected by V. L. Smith, August 13, 1956. One female and one larva from *Fragaria* sp. roots and soil, Dave Allen farm, Lithia, Florida, collected by the author, February 12, 1957. One female and one larva from *Citrus* sp. roots and soil, H. V. Grumbach Grove, Cherry Lane and Lateral A Road, Vero Beach, Florida, collected by the author, October 23, 1956. One female from *Citrus* sp. roots and soil, J. J. Schumann Grove, Clemens Avenue and Oslow Road, Vero Beach, Florida, collected by the author, October 23, 1956.

Diagnosis: *Pseudhalenchus* of relatively small size (0.412 microns average length), moderate annulation, short vestigial posterior uterus sac (6.4 microns average length), and exhibiting four incisures in the lateral field.

Pseudhalenchus anchilisposomus, n. sp. (Fig. 2 A-J)

Measurements: 19 females: L = 0.624 mm. (0.487-0.728 mm.); a = 33.9 (30.6-39.9); b = 4.7 (4.1-5.1)‡; c = 12.3 (11.1-13.2); V = $^{42}81$ (78-83) percent.

5 males: L = 0.584 mm. (0.428-0.678 mm.); a = 44.1 (38.6-48.4); b = 4.3 (3-8-5.1)‡; c = 9.9 (7.8-11.4); T = 49 percent (41-57 percent).

Somatic annulation fine to indistinct on preserved specimens. Lip region continuous with body (Fig. 2, A, C), faintly annulated in some specimens. Lips six in number; the submedian lips each bearing three faint papillae, and the lateral lips each appearing to bear an amphid aperture (Fig. 2, B). Female stylet 8.8 (7.6-10.8) microns long; male stylet 8.3 (6.2-9.9) microns long. Hemizonid protruding slightly, directly in front of excretory pore. Excretory pore situated 81 (74-95) microns from anterior end. Esophagus exhibiting weakly muscular metacorpus equipped with valves. Posterior portion of esophagus overlapping intestine (Fig. 2, G). Ovary monodelphic and prodelphic; outstretched. Vulva transverse, usually protruding slightly (Fig. 2, A, D). Rudimentary posterior uterus about 1½-2½ times as long as width of corresponding body diameter, actually measuring 32 (20-41) microns long. Testis of male outstretched, spicules arcuate 18.5 (17.1-20.3) microns long (Fig. 2, E, F). Gubernaculum 6.3 (5.5-7.2) microns long. Bursa (caudal alae) usually beginning in region of spicule cephalation, terminating at ½ to ⅔ the tail length. Tails conical with minute- to broadly-rounded termini (Fig. 2 A, D, I, J). Lateral field exhibits six incisures (Fig. 2, H). Phasmids not observed.

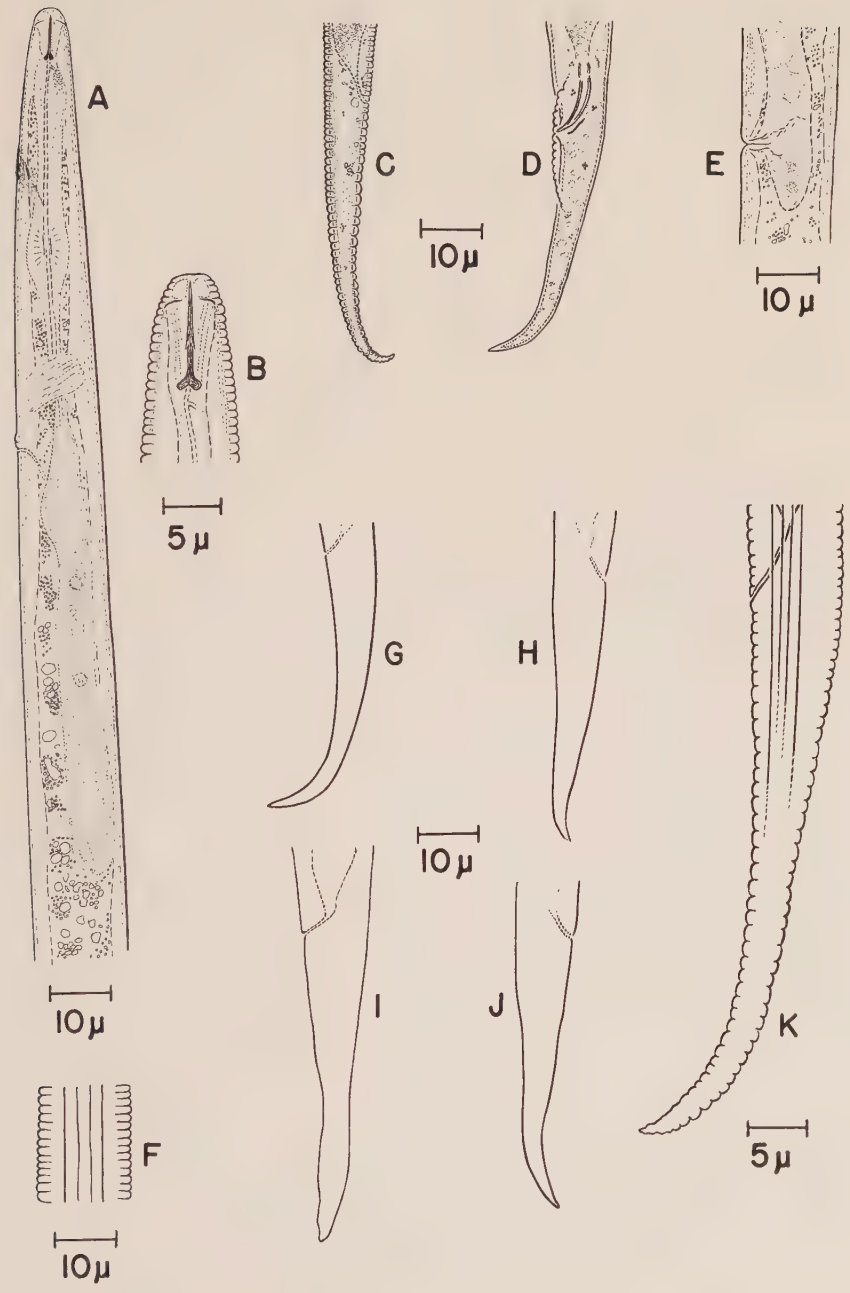


Fig. 1. *Pseudhalenchus minutus* A-K. Specimens from Lake-of-the-Hills, Florida. A. Female esophageal region; B. Stomatal region of female; C. Female tail; D. Male Tail; E. Vulva and posterior uterine branch; F. Lateral field at middle of female body; G-J. Female tail shapes; K. Lateral field and annulations on female tail.

The specific name "anchilisposomus" is of Greek derivation and consists of "anchi" meaning near, "lispos" meaning smooth, and "soma" meaning body. *Pseudhalenchus anchilisposomus,* when translated literally, means "false *Halenchus* (with) nearly smooth body."

Diagnosis: *Pseudhalenchus* of moderate size (624 microns average length), with fine to indistinct somatic annulation, relatively long vestigial posterior uterus (32.1 microns average length) exhibiting six incisures in the lateral field.

Holotype: Female collected by S. A. Sher and M. W. Allen, January 4, 1952. Slide 108, University of California Collection, Berkeley.

Paratypes: One female, Slide 109, University of California Collection, Berkeley. One *en face* mount of female head, and 2 females, Slides 12, 13, and 14 respectively, Tray 1, Cabinet C-2724, Nematode Collection, Citrus Experiment Station, Lake Alfred, Florida. Two females in author's possession.

Type Habitat: Soil around roots of grass.

Type Locality: Fifty feet east of steps, east side of Gianinni Hall, University of California, Berkeley, California.

Other Hosts and Localities: One female and 3 larvae, soil sample, Lodi, California, collected October 11, 1950 (Slide "California 260," University of California Collection). Four females and 1 male, soil sample, Berkeley, California, collected January 4, 1952 (Slide "California 307," University of California Collection). Nine females and 1 male, sugar beet roots and soil, West Jordan, Utah, collected September 21, 1940 (slides "13 Utah," University of California Collection). One female from tracks of a bulldozer eradicating citrus trees, Estes Grove, Alturas, Florida, collected by V. L. Smith, August 13, 1956. One female and one male, citrus roots and soil, Ocala, Florida, collected by R. Umbaugh October 17, 1956. One female, citrus roots and soil, W. H. McBride Grove, Deland, Florida, collected by J. A. Pinckard June 25, 1956.

Differential Diagnosis Between Species (Average Measurements, in microns unless otherwise shown).

	P. minutus	*P. anchilisposomus*
Body length	412.0	624.0
α	29.7	33.9
β*	3.3	4.7
γ	8.3	11.8
Stylet Length	8.3	8.8
Vulva**	73.0%	81.0%
Ovary***	30.0%	42.0%
Rudimentary posterior uterus, length	6.4	32.1
Testis***	33.0%	49.0%
Spicule length	12.9	18.5
Gubernaculum length	3.3	6.3
Bursa (caudal alae)	occupies approx. ⅓ of tail	occupies approx. ½-⅔ of tail
Body Annulation	moderate	fine to indistinct
Lateral Field	4 incisures	6 incisures

*As calculated using length from anterior end to base of esophageal lobe.
**Distance of vulva from anterior end expressed as percentage of total length.
***Length expressed as percentage of total body length.

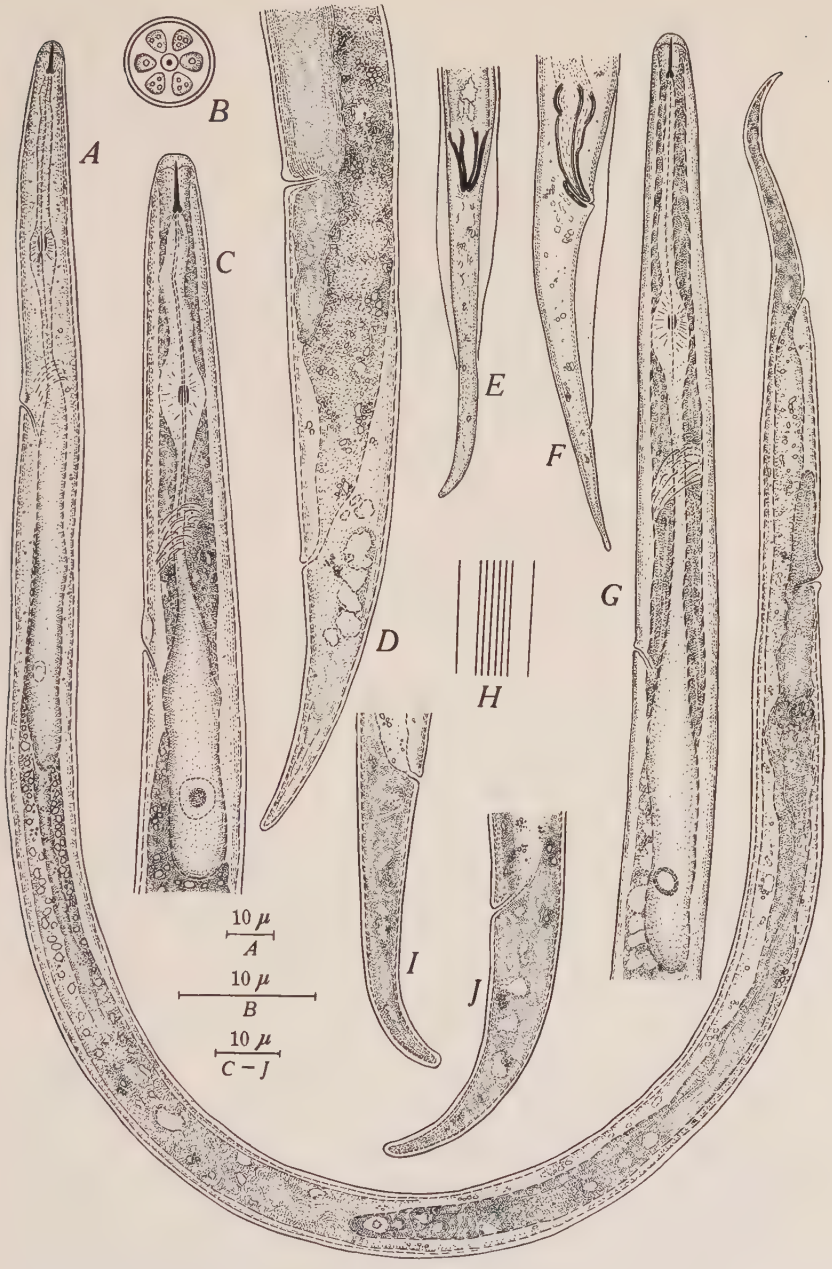


Fig. 2. *Pseudhalenchus anchilisposomus*. A, B, F, and G. Specimens from Berkeley, California. A. Adult female. B. Female face view. F. Lateral view of male tail. G. Esophageal region of female. C-D. Female specimens from Deland, Florida. C. Esophageal region. D. Posterior portion of body. E. Ventral view of tail, male from Ocala, Florida. H. Lateral field at middle of body, female from West Jordan, Utah. I J. Tails of females from Lodi, California.

Four New Species of *Parasitylenchus* (Nematoda) from Scolytid Beetles

C. L. MASSEY*

During the writer's examination of bark beetles for nematode parasites four new species of *Parasitylenchus* were collected. The species herein described were recovered from *Scolytus ventralis* Lec., *Ips avulsus* (Eichh.) and *Ips pilifrons* Sw. Two of the newly described species were taken from the body cavity of the last-mentioned insect.

The genus *Parasitylenchus* was erected by Micoletzky in 1922 and was originally proposed as a subgenus of *Tylenchus*. The type species *Parasitylenchus dispar* was described by Fuchs in 1915 and placed in the genus *Tylenchus*. Fuchs later described several species that are now included in the genus *Parasitylenchus*. They are, namely: *Parasitylenchus ligniperdi* (Fuchs 1929), *Parasitylenchus morosus* (Fuchs 1929), *Parasitylenchus sulphureus* (Fuchs 1929), *Parasitylenchus chalcographi* (Fuchs 1938), *Parasitylenchus poligraphi* (Fuchs 1938), *Parasitylenchus pusilli* (Fuchs 1938). The latter three species were described as subspecies of *P. dispar*. In addition to the species described by Fuchs, Wuelker (1923-1929) described *Parasitylenchus hylastis* and *Parasitylenchus cossoni*, the former species within the genus *Tylenchus*. *Parasitylenchus scolyti* was described by Oldham in 1930. Ruhm described *Parasitylenchus grossmannae* in 1954. For a more complete listing of the species in this genus the reader is referred to Wachek (1955) and Ruhm (1956).

Parasitylenchus elongatus, n. sp. (Fig. 1)

EGGS: Hatch within uterus of living female.

FIRST STAGE LARVAE: Length 0.30 mm.; width 0.03 mm.; spear not visible; lip region rounded; anal opening not visible; tail obtuse.

MATURING PARASITIC FEMALES FROM LARVAL INSECTS: Length 1.6-2.7 mm.; width 0.18 mm.; cuticle very finely striated, hypodermal cells with large nuclei; lip region rounded; spear moderately coarse knobbed; lumen of the esophagus visible for a considerable distance from the base of the spear; genital primordia apparent over approximately ½ of the body length; vulva and anal openings not visible.

IMMATURE PARASITIC FEMALES FROM ADULT BEETLES: Length 5.0-6.2 mm.; width 0.25 mm.; body elongate; cuticle thick, smooth, hypodermis with large cells; lip region flattened; spear moderately knobbed; lumen of the esophagus visible for only a short distance from the base of the spear; ovary well developed, reaching almost to the base of the spear in some specimens, reflexed several times; uterus occupying a large portion of the body cavity, in this stage of development filled only with eggs; vulva and anal opening visible, slightly protuberant; tail obtuse. Figures 1 A and B.

MATURE PARASITIC FEMALES FROM ADULT BEETLES: Length 4.7-4.9 mm.; width 0.25 mm.; body elongate becoming reduced in length because of the distortion of the body wall; cuticle thick wrinkled, appearing to be almost annulated; lip region flattened, in many specimens distorted and misshapen;

*Rocky Mountain Forest and Range Experiment Station.
U. S. Department of Agriculture, Forest Service, with headquarters at Colorado State University, Fort Collins, Colorado.
The writer wishes to express appreciation to Mr. Gerald Thorne for his valuable suggestions and review of the manuscript.

spear moderately coarse, .011 mm. in length, often displaced by the development of the ovary; ovary large reflexed several times; uterus large, occupying a major portion of the body cavity and becoming distended with larvae as the eggs hatch; vulva protuberant; anal opening invisible; tail obtuse. Figures 1 C and D.

DIAGNOSIS: Elongate *Parasitylenchus* with broadly rounded lip region and obtuse tail. Differs from other species of the genus in its greater length and width.

TYPE HOST: *Scolytus ventralis.*

TYPE LOCALITY: Sandia Mountains, Albuquerque, New Mexico.

The species is of especial interest as approximately 50 percent of the beetles examined, adults, larvae and pupae, were found to be infested with the parasite. Development of the parasite progresses with the development of the beetle. Immature females are found only in the larvae, pupae, and young adults of the insect. Mature parasitic females are found only in the mature adult beetles. Nothing is known of its effect on its host, but it is thought to be similar to that of *Sphaerularia dendroctoni* Massey and *Aphelenchulus reversus* Thorne in that the egg-laying capacity of infested females is greatly reduced.

Parasitylenchus pilifronus, n. sp. (Fig. 2)

PARASITIC FEMALE: Length 3.8-5.4 mm.; width 0.23 mm.; body elongate, anterior ⅓ of the body widest, tapering toward the posterior end; cuticle translucent, hypodermis composed of large irregular transparent cells as in Figure 2 C; lip region broadly rounded (Figure 2 B); spear .013 mm. long, slender with prominent knobs; ovary single, reflexed one to several times, often almost reaching the base of the spear; vulva and anal openings not apparent. Figure 2 A. Males unknown.

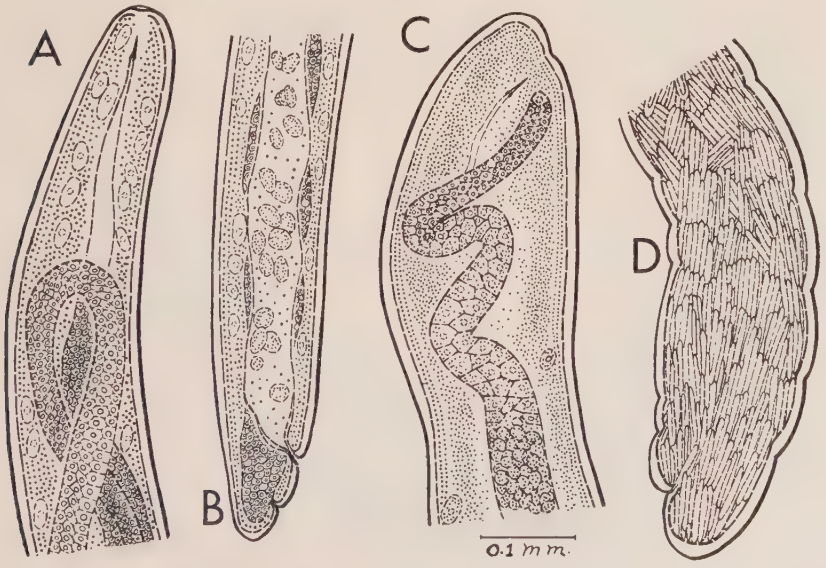


Fig. 1. *Parasitylenchus elongatus,* n. sp. A. Head immature parasitic female. B. Tail immature parasitic female. C. Head mature parasitic female. D. Tail mature parasitic female.

DIAGNOSIS: *Parasitylenchus* with translucent cuticle, differs from other species in the genus in the peculiar arrangement of the hypodermal cells and in their lack of color.

TYPE HOST: *Ips pilifrons.*

TYPE LOCALITY: Uncompahgre National Forest, Norwood, Colorado.

Parasitylenchus avulsi, n. sp. (Fig. 3 A)

EGGS: Hatch within uterus of parasitic females.

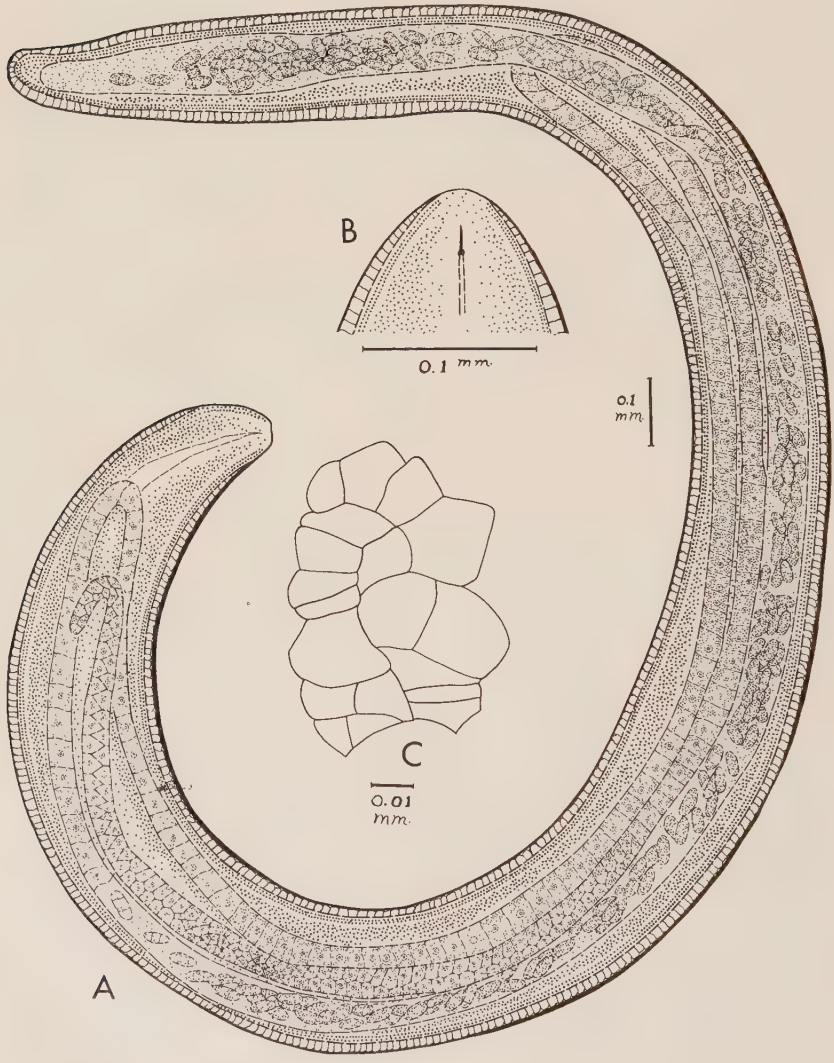


Fig. 2. *Parasitylenchus pilifronus,* n. sp. A. Parasitic female. B. Anterior portion parasitic female. C. Hypodermal pattern.

FIRST STAGE LARVAE: Length 0.29 mm., width .016 mm.; a = 17, b = ?, c = ?; lip region flatly rounded; spear slender, faintly knobbed; esophagus a narrow tube, narrowing even more as it passes through the prominent nerve ring; ectopore not visible, body cavity filled with large vacuole-like inclusions; anal opening not visible; tail narrowly rounded.

PARASITIC FEMALES: Length 1.2-1.55 mm., width 0.10-0.12 mm., a = 11, b = ?, c = 54, V = 98 percent, body sausage shaped, narrowing only slightly at the anterior and posterior ends, assuming circular shape when relaxed; cuticle smooth regular, hypodermis composed of cells with large nuclei; lip region, crown shaped, broadly rounded; spear moderately slender with prominent knobs, .013 mm. in length; lumen of the esophagus traceable for a short distance from the base of the spear; ovary reaching almost to the base of the spear, reflexed one to several times in mature specimens; uterus occupying a prominent part of the body cavity; vulva a narrow slit; anal opening subterminal only slightly separated from the vulva; terminus obtuse. Figure 3 A. Males unknown.

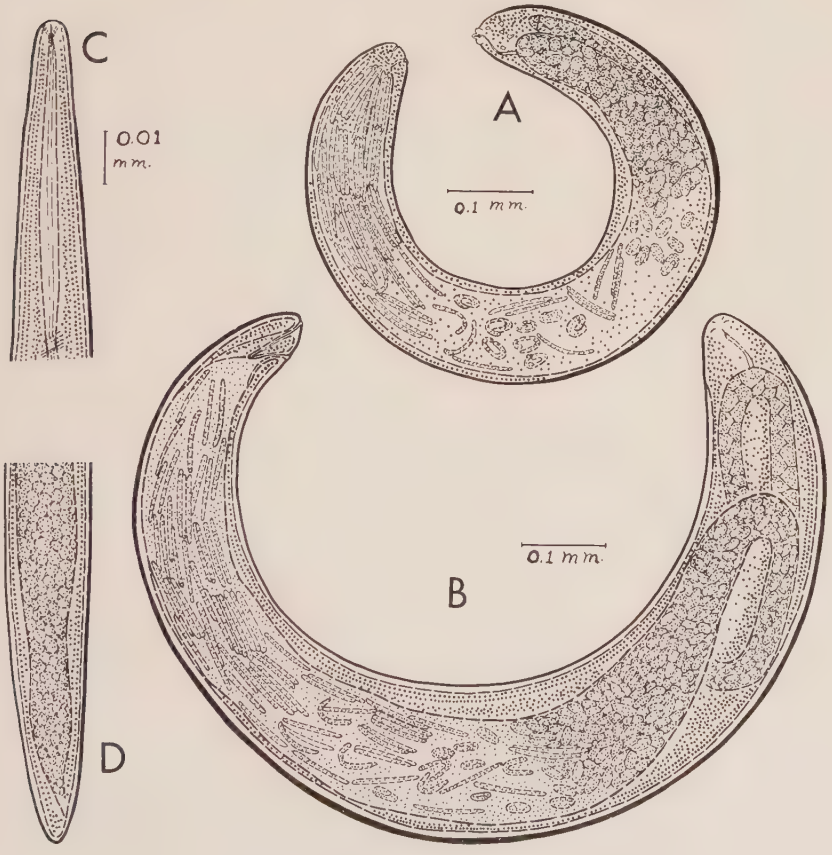


Fig. 3A. *Parasitylenchus avulsi*, n. sp. B-D. *Parasitylenchus ovarius*, n. sp. B. Parasitic female. C-D. Anterior and posterior portion of first stage larva.

Diagnosis: *Parasitylenchus* with crown-shaped lip region. Differs from *P. cossoni* in the shape of the lip region, the subterminal location of the vulva. It differs from *P. scolyti* in its larger size and shape of the terminus.

Type host: *Ips avulsus.*

Type locality: Talladega National Forest, Alabama.

P. avulsi was taken from the body cavity of adults *Ips avulsus* found associated with *Dendroctonus frontalis* Zimm. and *Ips grandicollis* (Eichh.).

Parasitylenchus ovarius, n. sp. (Fig. 3B-D)

Eggs: Hatch within uterus of adult females.

First stage larvae: Length 0.7 mm.; width 0.03 mm.; cuticle with faint striations nearly smooth; lip region flattened to very slightly rounded; spear slender, minutely knobbed; esophagus a narrow tube, becoming constricted as it passes through the nerve ring; nerve ring prominent; excretory pore not visible in specimens examined; genital primordia apparent; anal opening not visible; body cavity filled with vacuole-like inclusions. Figures 3 C and D.

Parasitic female: Length 1.7 mm.; width 0.16 mm., a = 11, b = ?, c = 8; body when relaxed assumes semicircular position, saclike in shape, broadest at the middle, narrowing at the anterior and posterior ends; lip region broadly rounded; spear, slender, .014 mm. in length with prominent knobs, often displaced by the growth of the ovaries, becoming nonfunctional in older specimens; lumen of the esophagus visible for only a short distance from the base of the spear; ovary single, reflexed; uterus filling a large portion of the body cavity in mature specimens; vulva and anal opening closely separated; tail narrowly obtuse. Figure 3 B. Males unknown.

Diagnosis: *P. ovarius* is closely related to *P. dispar* and *P. grossmannae.* It differs from *P. dispar* in its larger size and the terminal location of the anal opening; from *P. grossmannae* in the presence of discernible anal opening and the more narrowly rounded lip region.

Type host: *Ips pilifrons.*

Type locality: Uncompahgre National Forest, Norwood, Colorado. Only the adult beetles were infested with the parasite.

Literature Cited

Fuchs, G. 1915. *Tylenchus dispar curvidentis* m. und *Tylenchus dispar cryphyli* m. Zool. Anz. 45: 195-207.

————. 1929. Die Parasiten einiger Russel-und Borkenkafer. Zeit. Parasitenk 2: 248-285.

————. 1938. Neue Parasiten und Halbparasiten bei Borkenkafern und einige andere Nematoden. II. Zool. Jahrb. 70. Syst. 291-380.

Micoletzky, H. 1922. Die freilebenden Erdnematoden mit besonderer Berucksichtigung der Steiermark und der Bukowina, zugleich mit einer Revision samtlicher nicht mariner, freilebender Nematoden in Form von Genus—Beschreibungen und Bestimmungsschlusseln. Arch. Naturg. 87A 9: 1-650. 56 f.

Oldham, J. N. 1930. On the infestation of Elm Bark Beetles (Scolytidae) by a nematode *Parasitylenchus scolyti* n. sp. Jour. Helminth. 8: 239-248.

Ruhm, W. 1954. Einige neue Ipidenspezifische Nematodenartem Zool. Anz. Bd. 153, Heft 9/10.

————. 1956. Die Nematoden der Ipiden. Parasitologische Schriftenreihe, Heft 6. 148 Abbildungen, 13 Diagrammen, 10 Tabellen, 437 pp.

Wachek, F. 1955. Die entoparasitischen Tylenchiden. Parasitologische Schriftenreihe, Heft 3. 60 Abbildungen, 119 pp.

Wuelker, G. 1923. Uber Fortpflanzung und Entwicklung von *Allantonema* und verwandten Nematoden. Erg. Fortschr. Zool. 5: 389-507.

————. 1929. Bemerkungen zur Arbeit von G. Fuchs. Die Parasiten einiger Russel und Borkenkafer. Zeit Parasitenk. 2: 286-290.

The Parasitic Mites of *Myotis lucifugus* (Le Conte)*

CONRAD E. YUNKER

Department of Zoology, University of Maryland
College Park, Maryland

Between 1952 and 1953 approximately 500 vespertilionid bats indigenous to the eastern United States were examined for parasitic mites. The bats were collected from natural and artificial caves in the winter months and from house and church attics in summer months. Emphasis was placed upon collecting *Myotis lucifugus* (Le Conte, 1831) and only a small number of other species was taken for comparison. These were *Eptesicus fuscus fuscus* (Beauvois), *Pipistrellus subflavus* Cuvier, and *Corynorhinus rafinesquii* (Lesson). The following data include synonymy and previous records for each species of mite known to occur on *Myotis lucifugus,* and a number of new host and locality records (indicated by asterisk).

SUBORDER MESOSTIGMATA; FAMILY SPINTURNICIDAE

Spinturnix von Heyden, 1826

Spinturnix americanus (Banks)

Pteroptus americanus Banks, 1902, Canad. Entom., 34, pp. 173-174 (Indiana, off "bat").

Spinturnix americanus, Rysgaard, 1942, Amer. Mid. Naturalist, 28, pp. 256-262 (Minnesota, "considerable numbers" off *Eptesicus f. fuscus;* "several" off *Myotis l. lucifugus*).

Not recovered in this study.

Spinturnix echinipes (Banks)

Pteroptus echinipes Banks, 1910, Proc. Entom. Soc. Wash., 12, p. 5 (Homer, N. Y., off *Myotis lucifugus*).

Spinturnix echinipes, Stiles and Nolan, 1931, National Inst. Health Bull. (155), U. S. Pub. Health Serv., Dec., 1930, p. 708; Radford, 1942, Parasitology, 35, p. 59.

Not recovered in this study.

Spinturnix iowae Keegan

Spinturnix iowae Keegan, 1943, Bull. Brooklyn Entom. Soc., 38, p. 54 (Iowa, one specimen off *Myotis lucifugus*).

This species was recovered from 122 of 200 *Myotis l. lucifugus* collected on 29 August, 1953 in Chaptico, Md.* However, only one specimen was ever taken in the winter collections (*Myotis l. lucifugus,* Hibernia, N. J.*, 3 March, 1954). Van Eyndhoven (1950, Proc. Internat. Cong. Entom., 8, pp. 1008-1101) reports that many spinturnicids are seen in the summer on European bats, but never during the winter. These observations suggest that spinturnicids remain in the summer habitat when the bats are in hibernation.

---

*This paper is based on the author's dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science at the University of Maryland.

The author is grateful to Dr. G. W. Wharton, Professor and Head, Department of Zoology, University of Maryland, who suggested the problem, and to Dr. George Anastos, Associate Professor, who directed the course of the investigation. He also wishes to extend his appreciation to Dr. Frank Tromba, U. S. Department of Agriculture, who assisted with collections and to Drs. Edward W. Baker, David H. Johnson, and Charles O. Handley, Jr. who accorded advice and facilities at the U. S. National Museum during identification of parasites and hosts. The manuscript was prepared for publication at the U. S. Naval Medical Research Unit No. 3, Cairo.

Family Dermanyssidae

Ornithonyssus Sambon, 1928

Ornithonyssus haematophagus (Fonseca)

Liponissus haematophagus Fonseca, 1935, Mem. Inst. Butantan, 10, pp. 1-4 (Sittio de Matto, Rio de Janeiro, Brazil, five specimens off *Molossus abrassus, Molossus rufus,* or *Nyctinomus macrotis*).

Bdellonyssus haematophagus, Fonseca, 1941, Ciencia, Mexico, 2, p. 262; 1948, Proc. Zool. Soc. London, *118*(2), pp. 285, 289.

Liponyssus haematophagus, Radford, 1942, Parasitology, 35, p. 58; Morlan and Strandtmann, 1949, J. Parasitol., 35, p. 217, (Georgia, off *Myotis lucifugus* and *Tadarida cynocephala*).

Not recovered in this study.

Ichoronyssus Kolenati, 1858

Ichoronyssus quadridentatus Strandtmann and Hunt

Ichoronyssus quadridentatus Strandtmann and Hunt, 1951, J. Parasitol., 37, pp. 462-464 (Thomas Co., Georgia, one specimen each off *Eptesicus fuscus,* 8 April, 1947, and *Myotis lucifugus,* 26 February, 1948).

Not recovered in this study.

Steatonyssus Kolenati, 1858

Steatonyssus occidentalis (Ewing)

Ceratonyssus occidentalis Ewing, 1933, Proc. U. S. Nat. Mus., 82, pp. 10-11 (Adel, Oregon, four specimens off "Bat (?)*Myotis sp.",* 19 August, 1930); Dymond, 1938, Canad. Entom., 70, pp. 20-21 (Lake Nipissing, Canada, off *Myotis l. lucifugus*).

Steatonyssus occidentalis, Radford, 1950, Parasitology, 40, p. 374.

This species was collected during the present study from the following localities and hosts: Pendleton Co., W. Va.*, two specimens from *Eptesicus f. fuscus**, August, 1951; Shepherdstown, W. Va., four specimens from *Eptesicus f. fuscus,* 11 October, 1953; Franklin, W. Va., one specimen from *Eptesicus f. fuscus,* 20 October, 1953; Hagerstown, Md.*, two specimens from *Eptesicus f. fuscus,* 11 October, 1953; Chaptico, Md., four specimens from *Myotis l. lucifugus,* 29 August, 1953; College Park, Md., 10 specimens from *Eptesicus f. fuscus,* 29 September, 1953. In addition to these collections, one specimen of *S. occidentalis* was seen at the Helminthological Collection of the U. S. National Museum, collected in Washington, D. C. off *Lasiurus borealis* (Müller)* byA. McIntosh, 20 September, 1935.

Suborder Trombidiformes; Family Myobiidae

Neomyobia Radford, 1948

Neomyobia caudata (Banks)

Myobia caudata Banks, 1909, Proc. Entom. Soc. Wash., 11, p. 134 (Guelph, Ontario, off "little brown bat"); Radford, 1936, North West Naturalist, 11, p. 150; Ewing, 1938, Proc. Entom. Soc. Wash., 40, pp. 196-197.

Myobia canadensis Banks, 1909, Proc. Entom. Soc. Wash., 11, p. 143.

Radfordia caudata, Radford, 1950, Parasitology, 40, p. 464.

Neomyobia caudata, Jameson, 1955, J. Parasitol., 41, pp. 409-410.

Taken in the present study from *Myotis l. lucifugus* in N. J.*, Md.*, and W. Va.*, from both summer and winter habitats. A total of 373 bats out of

429 were infested, each harboring one to four mites. Three specimens were also collected from a single *Pipistrellus subflavus** in Hagerstown, Md., 11 October 1953.

FAMILY TROMBICULIDAE

Euschöngastia Ewing, 1938

Euschöngastia hamiltoni Brennan

Euschöngastia hamiltoni Brennan, 1947, J. Parasitol., 33, pp. 251-252 (Germantown, N. Y., 28 specimens off *Eptesicus f. fuscus,* 12 February, 1947; Millerstown, N. Y., five specimens off *Myotis subulatus leibii,* 17 March, 1946); Wharton and Fuller, 1952, *A Manual of the Chiggers,* Publ. Entom. Soc. Wash., p. 77; Fuller, 1952, Zool. Verh., Leiden, *18,* p. 184; Farrell, 1956, Proc. U. S. Nat. Mus. *106,* pp. 188-190; (Hardy Co., W. Va., three specimens off *Myotis lucifugus,* 20 April 1951).

Three specimens of *E. hamiltoni* were seen in this study from Renfrew Co., Ontario*, off *Myotis l. lucifugus,* 3 February 1953, and thirty-five specimens were taken from Wardentown, Va.* off *Eptisicus f. fuscus,* 20 November 1953.

Euschöngastia pipistrelli Brennan

Euschöngastia pipistrelli Brennan, 1947, J. Parasitol., 33, pp. 249-251 (Stone Co., Mo., 17 specimens off *Pipistrellus subflavus subflavus,* 11, 23 September, 1946); Wharton and Fuller, 1952, *A Manual of the Chiggers,* Publ. Entom. Soc. Wash., p. 81; Fuller, 1952, Zool. Verh., Leiden, 18, p. 184; Farrell, 1956, Proc. U. S. Nat. Mus., 106, pp. 137-137 (numerous collections from various localities in Pa., N. Y., Ill., Ky. and Ohio, off *Myotis l. lucifugus, M. sodalis, M. keeni septentrionalis, Pipistrellus s. subflavus,* and *P. subflavus obscurus,* all taken during spring, summer and fall months of 1946-1949 [one specimen examinel by Farrell was taken in 1884, from Schoharie Co., N. Y.]).

Euschöngastia miracoxa Brennan, 1948, J. Parasitol., 34, pp. 468-469 (Tomkins Co., N. Y., one specimen off *Myotis l. lucifugus,* 5 August 1947).

Nine specimens of *E. pipistrelli* were seen from two *Pipistrellus subflavus* in Pendleton Co., W. Va.*, October, 1951 and 11 October, 1953; and four specimens were taken from one *Myotis l. lucifugus* in Hibernia, N. J.*, 2 December 1953.

Trombicula Berlese, 1915

Trombicula myotis Ewing

Trombicula myotis Ewing, 1929, Entom. News, 40, p. 294 (Mt. Katahdin, Me., three specimens off *Myotis lucifugus,* 1 September 1928); 1931, Proc. U. S. Nat. Mus., 80, p. 9; Wharton, 1947, J. Parasitol., 37, pp. 260-264 (Monroe Co., Pa., eight specimens off *Myotis lucifugus,* 16 May 1945); Wharton and Fuller, 1952, *A Manual of the Chiggers,* Publ. Entom. Soc. Wash., p. 54; Brown and Brennan, 1952, Canad. J. Zool., 30, p. 342 (Elkwater [Cypress Hills], Alberta, off *Peromyscus leucopus,* 20 July, 1948.

Eutrombicula myotis, Ewing, 1938, J. Wash. Acad. Sc., 28, pp. 294-295; Radford, 1942, Parasitology, 35, p. 66.

Acariscus myotis, Ewing, 1943, Proc. Entom. Soc. Wash., 45, p. 65.

Trombicula eptesici Brennan, 1947, J. Parasitol., 33(3), pp. 247-248 (Hamilton, Montana, twelve specimens off *Eptesicus fuscus pallidus,* 24 August, 1935).

Trombicula russicum var. *myotis,* Fuller, 1952, Zool. Verh., Leiden, 18, pp. 49-51.

Twenty-one specimens of *T. myotis* were found in the present survey, on a single *Myotis l. lucifugus* from Renfrew Co., Ontario*, 2 March, 1953. Two specimens were taken from *Myotis l. lucifugus* in Pendleton Co., W. Va.*, October, 1951; seven and over 90 specimens were taken from two *Eptesicus f. fuscus* from Pendleton Co, W. Va., and Wardentown, Va.* respectively on 20 October, 1953.

Suborder Sarcoptiformes; Family Sarcoptidae

Teinocoptes Rodhain, 1923

Teinocoptes lasionycteris (Boyd and Bernstein) new combination.

Sarcoptes lasionycteris Boyd and Bernstein, 1950, Proc. Entom. Soc. Wash., 52, pp. 95-99 (Jefferson Co., Pa., four specimens off *Lasionycteris noctivagans,* 1948); Hedeen, 1953, J. Parasitol., 39, pp. 334-335.

Fourteen *T. lasionycteris* were taken from *Myotis l. lucifugus** in Shepherdstown, W. Va.*, 20 October, 1953, 29 specimens from *Corynorhinus rafinesquii** in Pendleton Co., W. Va., 29 October, 1953, and 26 specimens from *Myotis l. lucifugus* in Hibernia, N. J.*, 2 December, 1953.

While the specimens recorded here cannot be specifically separated from the types, they are not quite typical on the basis of body size and shape, and in the choice of site of attachment to the host, and may represent host varieties. Further study of the genus is needed in order to clarify specific characters.

Addendum. Two additional citations that should be noted were found after the manuscript had been prepared: *Dermatophagoides scheremetewskyi* Bogdanow, 1864 (Epidermoptidae) was recorded by Baker, Evans, Gould, Hull and Keegan (1956, *A Manual of Parasitic Mites,* Publ. Nat. Pest Contr. Assoc., p. 146) in Pennsylvania, off *Myotis lucifugus. Euschöngastia pipistrelli* Brennan, 1947 (Trombiculidae) was recorded by Jones, Loomis, Krutzsch, and Webb (1952, Trans. Kansas Acad. Sci., 55, pp. 313, 314) off *Myotis lucifugus, M. keeni septentrionalis* and *Pipistrellus s. subflavus* in Kansas, Oklahoma and Arkansas.

A New Dilepidid Cestode, *Paruterina reynoldsi,* from the Southern Crow, *Corvus brachyrhynchos paulus* Howell

Edward F. Daly

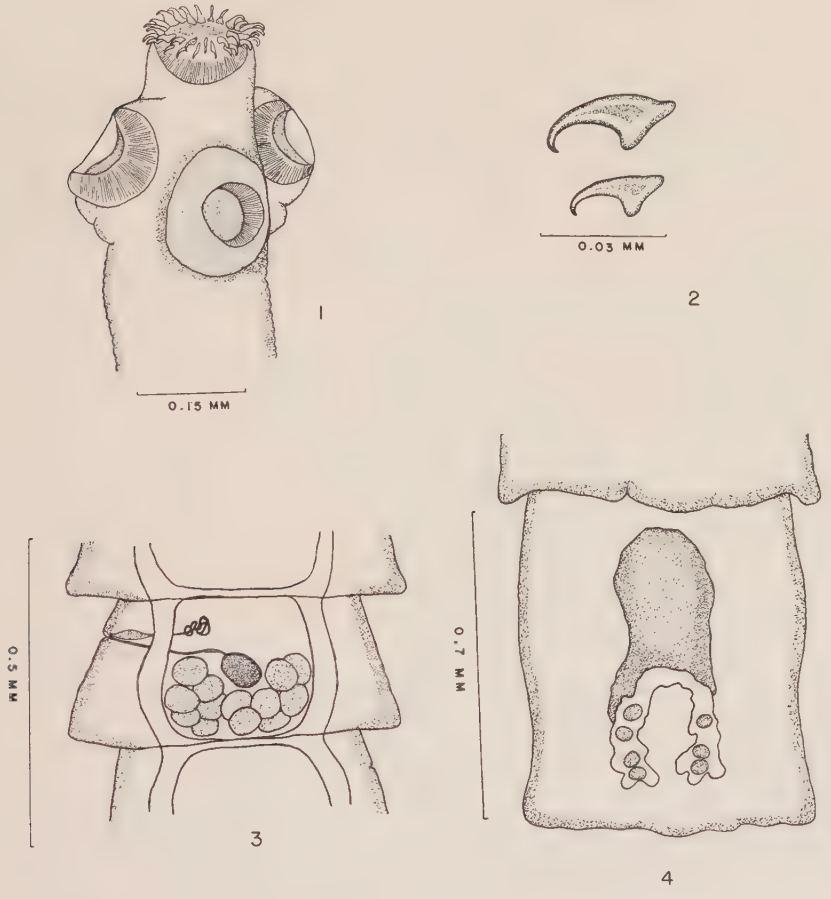
Miller School of Biology, University of Virginia, Charlottesville, Virginia

From the examination of four crows collected near Ruckersville, Virginia on November 6, 1956 were obtained complete specimens representing a new species of cestode. These belong to the genus Paruterina (Paruterininae Fuhrmann, 1907, Dilepididae Ralliet and Henry, 1909) which was erected by Fuhrmann in 1906. The species is described herein and named in honor of the late Dr. Bruce D. Reynolds, Professor of Zoology at the University of Virginia.

Paruterina reynoldsi, n. sp.

(All measurements in microns unless otherwise given)

Description.—Species of small size; type 36 mm long by 0.9 mm wide at broadest point, consisting of 132 proglottids. Scolex (Fig. 1) 350 in diameter; rostellum retractable within holdfast and prominent with a terminal, sucker-shaped, muscular structure 70 in depth and 115 wide. Rostellum armed with a double circlet of 44 to 48 hooks (Fig. 2), those of anterior circlet 33 long and those of posterior circlet 21 long. Suckers 130 to 165 in diameter. Mature proglottids (Fig. 3) wider than long. A relatively typical mature proglottid 0.55 mm wide and 0.25 mm long. Genital apertures lateral, irregularly alternate, and slightly anterior to equatorial level of proglottid. Gravid proglottids (Fig. 4) longer than wide, a terminal one 0.85 mm by 0.63 mm.



Paruterina reynoldsi, n. sp.

Fig. 1. Scolex.
Fig. 2. Lateral view of typical large and small hook.
Fig. 3. Mature prolgottid, ventral aspect.
Fig. 4. Gravid proglottid.

Male reproductive system: Testes 12 to 14 in number, spherical, 45 to 55 in diameter, posterior and lateral to ovary. Cirrus sac elongate, elliptical, anterior to vagina; vas deferens coiled, narrow, anterolateral to ovary, medial to lateral osmoregulatory ducts.

Female reproductive system: Ovary single, central, elliptical, 60 by 70; vagina relatively straight, uncoiled, thin-walled duct; vitelline gland, when evident, elliptical, postovarian, and surrounded by testes. Gravid uterus in posterior portion of proglottid and in shape of inverted-U. In terminal gravid proglottids uterine arms somewhat sinuous. Paruterine organ anterior to gravid uterus. Embryonic hooks of oncospheres 11 to 13 in length. Eggs within gravid uterus 38 to 42 in diameter.

Osmoregulatory system: Canals broad and slightly curved in mature proglottids. Ventral canals 40 in diameter, dorsals and transverse 25 in diameter.

Host: Southern crow, *Corvus brachyrhynchos paulus.*

Habitat: Small intestine.

Locality: Albemarle County, Va.

Specimens: U.S.N.M. Helm. Coll. No. 38201 (paratype), author's collection at the University of Virginia (type and (paratypes).

Relationships: Of the representatives of the genus, *P. angustata* Fuhrmann, 1906, *P. guineensis* Joyeux and Baer, 1928 and *P. southwelli* Hilmy, 1936 have unilateral genital apertures. The remaining species are differentiated from *P. reynoldsi* primarily by the size, shape, and number of hooks as well as the number and size of the testes, and the arrangement of the paruterine organ and the gravid inverted-U shaped uterus.

P. candelabraria (Goeze, 1782), *P. similis* (Ransom, 1909), *P. chlorurae* Rausch and Schiller, 1949, and *P. morgani* Rausch and Schiller, 1949 have been described from North American birds. The latter two species resemble *P. reynoldsi* more than other members of the genus. *P. chlorurae* has 40 to 42 rostellar hooks, 16 and 20 long, and 10 to 12 testes; *P. morgani* has 34 to 46 rostellar hooks, 40 and 66 long, and 15 to 18 testes; while *P. reynoldsi* has 44 to 48 rostellar hooks, 21 and 33 long, and 12 to 14 testes. Furthermore, *P. reynoldsi* may be distinguished from the two above species by the shape and size of the various parts of the rostellar hooks, the arrangement of the paruterine organ, and the gravid uterus. *P. reynoldsi* is the first representative of the genus to be reported or described from a North American crow.

The Genus Paruterina Fuhrmann, 1906

The genus *Paruterina,* with *P. candelabraria* (Goeze, 1782) as genotype, is characterized as follows: Rostellum armed with a double crown of hooks; genital apertures unilateral or alternating irregularly; testes lateral and posterior but mainly in rear of the ovary; gravid uterus inverted-U shaped with an anterior paruterine organ.

As presently constituted the genus *Prauterina* Fuhrmann, 1906 contains the following species: *P. angustata* Fuhrmann, 1906 *P. bovieni* Hűbscher, 1937; *P. bucerotina* Fuhrmann, 1909; *P. candelabraria* (Goeze, 1782), genotype; *P. chlorurae* Rausch and Schiller, 1949; *P. cholodkowskii* Skrjabin, 1914; *P. daouensis* Joyeux, Baer, and Martin, 1936; *P. guineensis* Joyeux and Baer, 1928; *P. javanica* Hűbscher, 1937; *P. meggitti* Johri, 1931; *P. morgani* Rausch and Schiller, 1949; *P. otidis* Baczynska, 1914; *P. parallelipida* (Rudolphi, 1809); *P. purpurata* (Dujardin, 1845); *P. reynoldsi,* n. sp.; *P. septotesticulata* Moghe and Inamdar, 1934; *P. similis* (Ransom, 1909); *P. southwelli* Hilmy, 1936; and *P. vesiculigera* (Krabbe, 1882).

Schistosoma sp. in Shrews in Lower Egypt*

ROBERT E. KUNTZ
Parasitology Department, U. S. Naval Medical Research Unit No. 2
Taipei, Taiwan

For years it was generally assumed that species of *Schistosoma,* other than *S. japonicum* in the Orient, were found only in man and some of the larger domestic and related animals. Exposure of laboratory animals to the schistosomes of man in Africa in the course of life cycle studies indicated that some of the smaller mammals could become infected (Leiper, 1918; Brumpt and Chevallier, 1931; and others). Later, more comprehensive and comparative studies (Stirewalt, *et al.,* 1951; Moore, *et al.,* 1949) involving the experimental exposure of representative lower mammals to the cercariae of the schistosomes definitely demonstrated that some of the smaller species, especially rodents, served quite effectively as definitive hosts for *S. mansoni.*

As a result of laboratory studies (Stirewalt, *et al. l.c.;* Kuntz and Malakatis, 1955; and others) demonstrating the relative susceptibilities of various animals to schistosome infection, a survey was made to learn whether mammals associated with the irrigation systems of Lower Egypt were naturally infected. Special emphasis was given to the examination of rodents and a single *Gerbillus p. pyramidum* Geoffrey, a small animal rarely associated with water, was found infected (Kuntz, 1952) with a parasite identified as *S. mansoni.* Examination of wild animals by other investigators in different parts of Africa (Schwetz and Stijns, 1951; Schwetz, 1953a, 1953b, 1956; Stijns, 1952) and South America (de Amorim, 1953; Barbosa *et al.,* 1953; Barbosa and Coelho, 1954) revealed not only a number of other animals infected with *S. mansoni* but also (in Africa) the presence of other closely related schistosomes. The latter constitutes a category which has been referred to as a "*Schistosoma mansoni* complex."

Continued search of mammals in Egypt revealed the presence of schistosomes in several shrews, *Crocidura olivieri* Lesson, captured in the vicinity of Beni Salâma and Wardân, Giza Province, 22 to 24 miles northwest of Cairo. A study of these parasites has provided the data for the present report.

MATERIALS AND METHODS

Numerous small mammals were trapped weekly or captured with the assistance of experienced Arab animal collectors. In most instances the hosts to be examined were transported to the laboratory alive and were necropsied within 1 to 3 days. The few animals taken in snap traps were placed in a refrigerator upon return to the laboratory and were examined as soon as feasible, i.e., 3 to 6 hours. Shrews were examined soon after capture since they usually died within 24 hours in captivity and the intestinal contents deteriorated rapidly.

Viscera were removed from the host's body intact, then the different organ systems were carefully examined under a dissecting scope as the tissues were cut with small tissue scissors or were macerated with splinter forceps.

*The opinions and assertions contained herein are the private ones of the author and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

The author is indebted to Harry Hoogstraal, Head of the Department of Medical Zoology NAMRU-3, who gave assistance in obtaining the many wild animals examined. He also has provided host identifications. The author also wishes to acknowledge George M. Malakatis, HM1, USN, for technical assistance.

Tissues were shaken in a stoppered flask and washed several times with physiologic saline to remove the smaller parasites missed during the preliminary examination. Schistosomes were removed from mesenteric veins with the aid of small sharpened dissecting needles.

Parasites were fixed in hot FAA (formalin-acetic acid-alcohol), then were stored in 65 per cent alcohol plus 1 per cent glycerine. Schistosomes for this study were stained with borax carmine in acid alcohol or with Delafield's hematoxylin. Specimens were cleared, measured and studied in methyl salicylate, then mounted in clarite.

Schistosoma sp.

The descriptions given are based upon a study of specimens nearing maturity as indicated by the presence of immature eggs in the uterus of the female schistosomes and spermatozoa in the seminal vesicle of the male. There was a total of approximately 40 schistosomes removed from the mesenteric vessels of 7 shrews. The parasites were damaged in removal from the hosts and unfortunately tissues associated with the older schistosomes were not examined microscopically for the presence of eggs.

MALE:* Body length, 2971 to 3677; maximum width just posterior to the acetabulum, 112 to 164. Oral sucker, length 97 to 138; width 78 to 123. Acetabulum, length 112 to 164; width 108 to 164. Body-length-relationships; anterior end of parasite to acetabulum, 289 to 321 (8.7 to 10.9 per cent of body length); anterior end to bifurcation of gut 216 to 239 (6.8 to 7.0 per cent of body length); anterior end to posterior fusion of gut, 963 to 1573 (36.4 to 42.7 per cent of body length). Oral sucker and acetabulum well developed, cupped surfaces with slightly thickened cuticle bearing minute spine-like processes. Body surface smooth except for fine circular striations of cuticle and areas with body well crenate, due perhaps to fixation. One or 2 unicellular glands associated with orifice in oral sucker. Esophagus divided just anterior to acetabulum. Gland cells surround most of esophagus, the cell mass constricted midway between oral sucker and gut bifurcation, giving an hour-glass appearance. Ceca near esophageal bifurcation with lateral and interior expansions or pouches and a transverse commissure at level of acetabulum in some specimens. Posterior cecal fusion near middle but in anterior half of body. Testes variable in size, posterior to the acetabulum and 7 to 8 in number but usually 8. Epithelial-lined seminal vesicle with spermatozoa located just behind or slightly dorsal to acetabulum. Inner surfaces of gynecophoric canal with slightly thickened cuticle, surface roughened by minute spine-like thickenings or processes. Several prominences or elevations of body wall directed inwardly on anterior part of folds at beginning of gynecophoric canal, opposite to genital opening. Gynecophoric canal extends to near posterior end of body, the right (?) side being the shorter of the two folds.

FEMALE:* Body length, 2890 to 5183; maximum width posterior to acetabulum 86 to 101. Oral sucker, length, 74 to 86, width 56 to 63. Acetabulum, length 52 to 59, width 37 to 63. Body-length-relationships; anterior end of parasite to acetabulum, 230 to 256 (4.4 to 8.0 per cent of body length); anterior end to bifurcation of gut 187 to 243 (4.4 to 8.6 per cent of body length); anterior end to posterior fusion of gut 1702 (33 per cent of body length); anterior end to ovary 950 to 1431 (27.5 to 47.2 per cent of body length). Ovary, length 115 to 164. Mehlis gland, length 59 to 67; width 41

(*all measurements given in microns)

to 44. Both the convoluted ovary and Mehlis gland are prominent and the oviduct originates from the posterior end of the ovary. There are numerous egg cells in the oviduct and 1 or 2 immature eggs just anterior to the Mehlis gland. In some specimens poorly developed eggs with crumpled shells lie in the anterior portion of the uterus near its opening posterior to the acetabulum. Body covering smooth as in the male.

DISCUSSION

These parasites are not described as a new species since only a limited number of intact specimens were available for study, the characteristics of the mature egg are unknown and there was no opportunity for observations on the life cycle. While the general characteristics and anatomical relationships are similar to those of *Schistosoma mansoni,* these schistosomes, as compared with *S. mansoni* in a comparable stage of sexual maturity, are sufficiently different in appearance and in size to warrant this brief description.

The fact that these parasites were found in the same general area in which an infected gerbil was captured during earlier investigations (Kuntz, 1952) and that 7 or 16 shrews harbored schistosomes, suggest the possibility of a rodent or lower mammal schistosome species. Schwetz (1953a, 1956) and coworkers in Central Africa have made an extensive study of the *S. mansoni*-like schistosomes and have given a considerable list of rodents as natural hosts for *S. rodhaini* and *S. mansoni* var. *rodentorum.* Although parasites were absent Stijns (1952) found eggs similar to those of *S. mansoni* in the tissues of the shrew, *Crocidura luna.*

The schistosomes reported herein from rodents are apparently representatives of the *S. mansoni*-complex of lower mammals. Differentiation of species or lesser taxonomic categories in this group is not easy since the distinguishing features are concerned with egg shapes and with differences of pathogenicity of the parasite in the definitive host.

After a 3-year search for schistosomes in wild mammals, the present lot of material was obtained only a few days prior to departure from Egypt. Subsequent examination of shrews and other hosts in Lower Egypt by Mr. W. H. Wells of Naval Medical Research Unit #3 failed to produce additional specimens for study. It is obvious, however, that additional studies are required to satisfactorily explain the relationship between *S. mansoni*-complex in lower mammals and to develop our knowledge of the biology of the latter group.

SUMMARY

Numerous mammals common to the irrigated areas of Lower Egypt were examined to determine whether any were naturally infected with schistosomes. Seven of 16 shrews, *Crocidura olivieri,* from one area were infected with a total of approximately 40 schistosomes. These parasites, although similar to *S. mansoni,* are sufficiently different to warrant a brief description. Their true identity remains unknown and they are not described as a new species since pertinent data such as shape of the mature egg, etc., are lacking.

LITERATURE CITED

DE AMORIM, J. P., 1953. Infestação experimental e natural de murideos pelo *Schistosoma mansoni.* Nota prévia. Rev. Brasil. Malariol. 5: 219-222.

BARBOSA, F. S., DOBBIN, J. E. and COELHO, M. V., 1953. Infestação natural de *Rattus rattus frugivorus* por *Schistosoma mansoni* em Pernambuco Publicações Avul. Inst. Aggeu Magalhães 2: 43-46.

Barbosa, F. S., e Coelho, M. V., 1954. Infestação natural de *Didelphis paraguayensis paraguayensis* (Marsupialia, Didelphidae) por *Schistosoma mansoni* em Pernambuco. Publicações Avuls. Inst. Aggeu Magalhães. 3: 1-3.

Brumpt, E. et Chevallier, P., 1931. La rate et les splénohepátites des bilharzioses expérimentales. Ann Parasitol. 9: 15-67.

Kuntz, R. E., 1952. Natural infection of Egyptian gerbil with *Schistosoma mansoni*. Proc. Helm. Soc. Wash. 19: 123-124.

Kuntz, R. E. and Malakatis, G. M., 1955. Susceptibility studies in schistosomiasis. II. Susceptibility of wild mammals to infection by *Schistosoma mansoni* in Egypt, with emphasis on rodents. Am. J. Trop. Med. and Hyg. 4: 75-89.

Leiper, R. T., 1918. Report on the results of the bilharzia mission to Egypt, 1915. Part V. Adults and ova. J. Roy. Army Med. Corps 30: 235-253.

Moore, D. V., Yolles, T. K. and Meleney, H. E., 1949. A comparison of common laboratory animals as experimental hosts for *Schistosoma mansoni*. J. Parasitol. 35: 156-170.

Schwetz, J. et Stijns, J., 1951. Sur la redécouverte de *Schistosoma rodhaini* Brumpt et la découverte de son hôte definitif. Compt. Rend. Soc. Biol. 145: 1255-1257.

Schwetz, J., 1953a. Sur quelques rongeurs sauvages et une musaraigne du Congo, hôtes naturels de deux schistosomes. Bull. Inst. Roy. Colon. Belge 24: 1453-1463.

Schwetz, J., 1953b. On a new schistosome of wild rodents found in the Belgian Congo, *Schistosoma mansoni* var. *rodentorum*, var. nov. Ann. Trop. Med. and Parasitol. 47: 183-186.

Schwetz, J., 1956. Rôle of wild rats and domestic rats (*Rattus rattus*) in schistosomiasis of man. Trans. Roy. Soc. Trop. Med. and Hyg. 50: 275-282.

Stijns, J., 1952. Sur les rongeurs hotes naturels de *Schistosoma rodhaini* Brumpt Ann. Parasitol. 27: 385-386.

Stirewalt, M. A., Kuntz, R. E., and Evans, A. S., 1951. The relative susceptibilities of the commonly-used laboratory mammals to infection by *Schistosoma mansoni*. Am. J. Trop. Med. 31: 57-82.

A Description of *Maritreminoides raminellae*, n. sp. (Trematoda: Microphallidae)*

Donald W. Dery**

During the regular Connecticut hunting season of 1952 and 1953, twenty-three Red-breasted Mergansers, *Mergus serrator* Linnaeus, were examined for parasites (Dery, 1954). Many microphallid trematodes were recovered from the intestines of seven of the above birds, collected at Ram Island, Barn Island and Clinton, Connecticut. These appear to represent a new species in the genus *Maritreminoides* Rankin, 1939, and are described below. This study is based on 150 worms. These were fixed in A.F.A. or Bouin's fixative under slight pressure, then stained in Ehrlich's haematoxylin, Ward's haematin (Ward's Natural Sciences, 1953, page 70) or Gower's modified carmine (Gower, 1939) and mounted whole. After study, several worms were removed from slides, sectioned transversely or sagittally and restained with Delafield's haematoxylin and eosin. All measurements are in millimeters and were taken from ten specimens unless otherwise stated.

*Contribution from the Department of Zoology and Entomology, University of Connecticut, Storrs, Connecticut and the Department of Biological Sciences, Division of Zoology, Florida State University, Tallahassee, Florida.

**The author is indebted to Drs. L. R. Penner and R. B. Short, who directed this study and to Mr. Allen McIntosh for the prompt loan of type specimens.

Present Address: Department of Biological Sciences, Florida State University, Tallahassee, Florida.

Maritreminoides raminellae, n. sp.

DESCRIPTION: *Maritreminoides.* Body elongate-oval, 0.75-0.99 × 0.20-0.23 immediately posterior to the acetabulum; except for extreme posterior end, covered with short stout spines having appearance of imbricate scales. Oral sucker subterminal, 0.067-0.071 × 0.067-0.078. Prepharnyx 0.047-0.078 long, widening toward pharynx which measures 0.039-0.047 × 0.034-0.039. Esophagus long, 0.17-0.27. Caeca short, 0.13-0.19, not extending beyond acetabulum; each lined with large cells. Acetabulum approximately same size as oral sucker, 0.063-0.078 in diameter. Testes oval; lying in lateral fields of posterior third of body, 0.049-0.081 × 0.037-0.053, long axes usually converging anteriorly. Vasa efferentia joining on the right side of body just anterior to ovary forming a short vas deferens which enters seminal vesicle. Seminal vesicle elongate oval, 0.065 long (average of 3 specimens), filled with sperm in mature specimens. Prostatic vesicle small, receiving the ducts of the numerous prostate glands which are enclosed in the cirrus pouch and surround the muscular cirrus. Cirrus present, when not everted, 0.05 long, reaching from prostatic vesicle to genital atrium. Cirrus pouch 0.117-0.133 long, considerably wider nearer genital atrium than proximally. Ovary retort-shaped, postero-dextral to acetabulum, 0.038-0.060 × 0.025-0.049, never contiguous with right testis but sometimes overlapping acetabulum and occasionally covering it. Oviduct extending postero-medially. Seminal receptacle medial to ovary. Main vitelline duct crossing oviduct ventrally, then looping posteriorly to join oviduct immediately before oötype. Oötype near postero-dextral edge of acetabulum, lined with a single layer of cuboidal cells. Mehlis' gland consisting of numerous cells surrounding dextral end of oötype and part of oviduct. Uterus filling posterior body with descending and ascending coils, finally passing forward dorsal to left vitelline duct. Metraterm thick-walled, looping dorsal to genital atrium before discharging into it. Genital atrium located on left side of acetabulum with genital pore ventral. Vitelline glands not extending beyond acetabulum anteriorly or behind testes posteriorly, composed of 9-11 follicles in each lateral field, usually overlapping testes and ovary ventrally and generally extending further anteriorly on right side. Right and left vitelline ducts joining median vitelline reservoir ventrally. Laurer's canal not observed. Eggs operculate, .015-.018 × .009-.013.

DEFINITIVE HOST: *Mergus serrator,* The Red-breasted Merganser.

HABITAT: Intestine.

INCIDENCE OF INFECTION: 7 of 23 mergansers.

LOCALITY: Ram Island, Barn Island and Clinton, Connecticut.

HOLOTYPE: Deposited in the U.S.N.M. Helm. Col. No. 55631.

PARATYPES: Deposited in the U.S.N.M. Helm. Col. No. 55632 and also in the collections of the Univ. of Conn., Florida State Univ., and the author.

DISCUSSION

According to Cable and Kuns (1951), the family Microphallidae includes eight genera: *Microphallus* Ward, *Levinseniella* Stiles and Hassall, *Maritrema* Nicoll, *Spelophallus* Jägerskiold, *Microphalloides* Yoshida, *Pseudospelotrema* Yamaguti, *Gynaecotyla* Yamaguti, and *Carneophallus* Cable and Kuns. *Pseudosupelotrema* was suppressed as a synonym of *Maritrema,* and *Maritreminoides* Rankin was retained by Etges (1953). Etges (1953) also synonymized *Gynaecotyla* with *Microphalloides* on the basis of the dextral genital pore, chintinous plates associated with the genital structure, and extrinsic

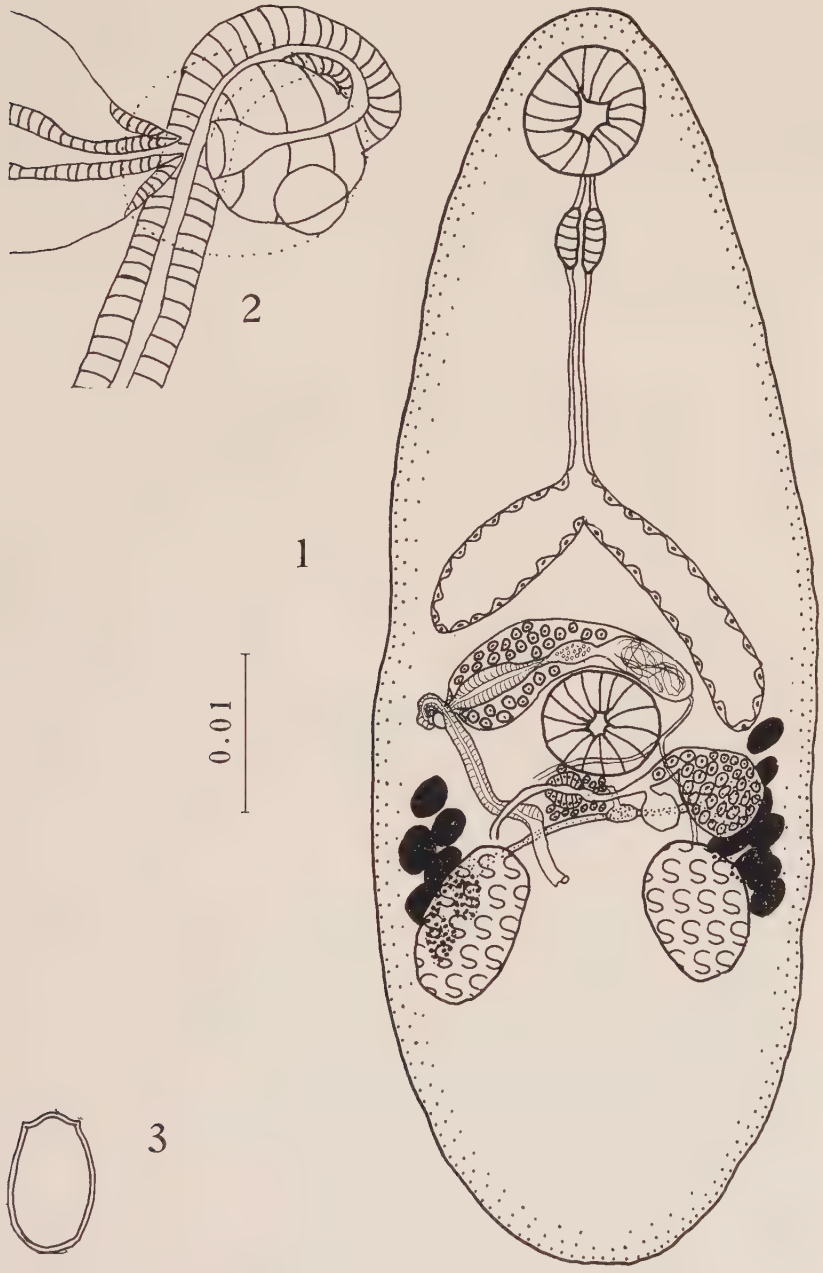
muscles associated with the genital atrium. The author is unable to accept this latter change, since the male copulatory structures are apparently quite different and the author has found a species of *Gynaecotyla* (to be described), which has a sinistral genital pore. Actually, as in many other descriptions of species in this family, Yoshida's description of the genital apparatus is not detailed enough to ascertain the true structure of the genital apparatus. Therefore, as it is easier in general to synonymize than split, the author prefers to accept both genera until *Microphalloides* is restudied. The author does agree that *Microphalloides* and *Gynaecotyla* are closely related and believes that *Microphalloides* may represent an intermediate stage in the evolution of *Gynaecotyla*.

The microphallid genera are easily separated into two groups: Those with a cirrus pouch and those without. The four genera containing species with a cirrus pouch can be separated into two groups. One group includes species with one acetabulum and a sinistral genital pore (*Maritrema* and *Maritreminoides*). The other group includes species with two acetabula and either a dextral or sinistral (a species to be described) genital pore (*Gynaecotyla*) and species with a single acetabulum and a dextral genital pore (*Microphalloides*). *Maritrema* and *Maritreminoides* have been separated on the basis of the following characters:

1. Position and shape of the vitelline clusters.
2. Extent of the uterine coils.
3. Presence or absence of a cirrus.

It has been shown that the first two of these characters are of little taxonomic value. Etges (1953) noted that the vitellaria of *Maritrema obstipum* showed all the variations found among microphallid genera. Etges also noted that the extent of the uterine coils was dependent on the distention of the excretory bladder. As for the presence or absence of a cirrus, considerable confusion exists. For example, Yamaguti (1939) erected the genus *Pseudospelotrema* characterized by a cirrus and described the copulatory structure of *P. japonicum,* the type species, as a papilla. The uncertainty as to the presence of a cirrus in *Pseudospelotrema* caused Etges (1953) to reduce this genus to synonymy with *Maritrema. Maritrema obstipum* (Van Cleave and Mueller, 1932) was originally placed in the genus *Microphallus,* which is characterized by the absence of a cirrus. Rankin (1939) placed it in the genus *Maritreminoides* after deciding that a short cirrus was present. Etges (1953) concluded that it did not possess a cirrus but rather a papilla and placed it in the genus *Maritrema.* It is noteworthy that Etges (1953) pointed out that the presence or absence of a cirrus is difficult to determine. After a review of the literature and an examination of many specimens the author concludes that the only valid criterion for separating *Maritrema* from *Maritreminoides* is the presence or absence of a cirrus. Due to the difficulty of determining whether a specimen in this family has a cirrus or a papilla, it is the author's opinion that unless the cirrus is seen everted or unless sectioned material is studied, that specimen cannot be adequately described. If we accept Etges reduction of *Pseudospelotrema* and consequent retention of *Maritreminoides,* Rankin, 1939, the genus *Maritreminoides* contains the following species:

Maritreminoides nettae (Gower, 1938) Rankin, 1939
Syn: *Maritrema nettae* Gower, 1938
M. ammospizae (Hunter and Vernberg, 1953) Etges, 1953
Syn: *Pseudospelotrema ammospizae* Hunter and Vernberg, 1953
M. raminellae n. sp.



Maritreminoides raminellae, n. sp.

All figures were drawn with the aid of a camera lucida. Scale (Fig. 1) in millimeters.

Fig. 1. Dorsal view.

Fig. 2. Ventral view of the genital apparatus. Reconstructed from sectioned material.

Fig. 3. Egg.

Of the three species of *Maritreminoides, M. raminellae* n. sp. most closely resembles *M. ammospizae* (Hunter and Vernberg, 1953). However, there are consistent differences between them. In *M. ammospizae* the cirrus pouch is widest aporally and in *M. raminellae* it is widest porally. The prostate glands are much more strongly developed in *M. raminellae.* The uterus does not pass anterior to the cirrus in *M. ammospizae,* while it does in *M. raminellae.* In addition, *M. raminellae* possesses a longer and narrower body and smaller suckers, testes, and voary. The size differences are inversely proportional to body size, whereas, if the differences in organ size were due to the method of fixation, one would expect them to be larger in the larger species, *M. raminellae.*

Summary

M. raminellae is described as a new species. The author stresses that the position and shape of the vitelline glands and the extent of the uterus are not valid criterion for the separation of microphallid genera, and that sectioned material must be studied for an accurate determination of the type of male copulatory structure, unless a cirrus is everted.

Literature Cited

Cable, R. M. and Kuns, M. L. 1951. The trematode family Microphallidae with the description of *Carneophallus trilobatus* gen. et sp. nov., from Mexico. J. Parasitol., 37: 507-514.

Dery, D. W. A study of the helminth parasites of the Red-breasted Merganser, *Mergus serrator* Linnaeus. (Unpublished Master's Thesis, University of Connecticut, Storrs. 55 pp. Submitted 1954).

Etges, F. J. 1953. Studies on the life histories of *Maritrema obstipum* (Van Cleave and Mueller, 1932) and *Levinseniella amnicolae* n. sp. (Trematoda: Microphallidae). J. Parasitol., 39: 643-662.

Gower, W. C. 1938. Seasonal abundance of some parasites of wild ducks. J. Wildlife Management, 2: 223-232.

————. 1939. A modified stain and procedure for trematodes. Stain Tech., 14: 31-32.

Hunter, W. S. and Vernberg, W. B. 1953. *Pseudospelotrema ammospizae* sp. nov., (Trematoda: Microphallidae) from the seaside sparrow, *Ammospizae maritima macgillivrai* (Audubon). J. Parasitol., 39: 84-87.

Rankin, J. S. 1939. Studies on the trematode family Microphallidae, Travassos, 1921, 111. The genus *Maritrema* Nicoll, 1907, with description of a new species and a new genus, *Maritreminoides.* Am. Midland Naturalist, 22: 438-451.

Van Cleave, H. J. and Mueller, J. F. 1932. Parasites of the Oneida Lake fishes. Part 1. Descriptions of new genera and species. Roosevelt Wild Life Ann., 3: 5-7.

Yamaguti, S. 1939. Studies on the helminth fauna of Japan. Part 25. Trematodes of birds. IV. Jap. J. Zool., 8: 129-210.

Yoshida, S. 1938. On a new genus Microphalloides of the trematode. Annot. Zool. Jap., 17: 327-337.

A New Genus of Monogenetic Trematode (Family Diclidophoridae) from a New Zealand Fish*

H. W. MANTER AND GAIL WALLING

These monogeneans were collected by the senior author in Wellington, New Zealand in 1951 from the gills of *Seriolella brama* (Günther), the warehou (Family Nomeidae). A study of the three specimens collected indicates they belong to a new genus of the family Diclidophoridae, subfamily Cyclocotylinae.

Eurysorchis australis, n. gen., n. sp. (Figs. 1-8)

HOST: *Seriolella brama* (Günther)

LOCATION: Gills.

LOCALITY: Wellington, New Zealand.

NUMBER: Three specimens on one host.

HOLOTYPE AND PARATYPE: U. S. Nat. Mus. Helm. Coll. No. 38233 and No. 38234.

DESCRIPTION: (based on 3 specimens; measurements in mms.):

Total length including haptor 9.5 to 10.; greatest width of body 0.5 to 1.; greatest width of haptor 1. to 1.5. Haptor not sharply set off from body, with 8 pedunculated suckers. Stalks of suckers short and broad. Body with a slight lateral constriction about 1.3 from anterior end. Haptoral suckers 0.702 to 0.780 by 0.624 to 0.741. Each sucker with a proximal and a distal unpaired sclerite, and 4 pairs of other sclerites (Fig. 2). The largest sclerite is the T-shaped, proximal, unpaired piece. It articulates with an unpaired, median, distal sclerite, and with two lateral, or equatorial, sclerites. The other three pairs of sclerites are circumferential; the proximal pair each has a proximal flange extending its entire length. The distal quadrants of the suckers bear parallel chitinous ridges. One of the proximal quadrants is without ridges, but has a papillated pad; the other proximal quadrant has traces of ridges and no pad.

Anterior suckers on each side of mouth, about 0.195 long. Pharynx about 0.156 long by 0.140 wide; esophagus about 0.546 long, bifurcating dorsal to genital pore. Intestinal ceca largely covered by vitellaria, with lateral and median outpocketings posterior to ovary, uniting in anterior part of haptor, common cecum much branched within haptor.

Ovary median, at beginning of posterior third of body proper, or near middle of total body length (including haptor), consisting of a folded tube. Oviduct arising from left anterior end of ovary; at first convoluted along anterior border of ovary, then extending backward along right side of ovary to join Mehlis' gland immediately posterior to ovary (Fig. 3). Vitelline follicles closely associated with intestinal ceca from a level a little posterior to lateral constrictions of body to posterior end of haptor. Common yolk duct extends backward along right side of ovary, sending an anterior branch to connect with the seminal receptacle and a posterior branch to Mehlis' gland; the anterior branch continuing forward as the vitello-intestinal canal (Fig. 3). Elongate seminal receptacle to right of and mostly anterior to ovary. Vagina lacking. Uterus extending straight forward to genital atrium. Eggs, 13 to 14 in number, ovoid, with both an anterior and a posterior filament. Body of egg about 0.127 by 0.068; posterior filament 0.218 to 0.468

*Studies from the Department of Zoology, University of Nebraska, No. 292.

long, usually with terminal swelling; anterior filament usually somewhat shorter (Fig. 4).

Testes spherical, very numerous, distributed both anteriorly and posteriorly to ovary, and in haptor. Anterior to ovary about 70 testes are in two irregular rows, one on each side between uterus and vitellaria. Posterior to ovary, about 275 testes, filling middle of body between ceca and between branches of ceca in haptor (Fig. 1). Seminal vesicle a slightly convoluted tube extending from just anterior to ovary to cirrus. Cirrus (Fig. 5) circular, 0.115 to 0.150 in diameter, almost directly dorsal to genital atrium, with radial muscles, and a ring of 8 hooks. Hooks pointing inwardly, with ventral root and a weakly chitinized, outwardly directed, pointed root. Length of blade about 0.01.

Genital atrium circular, non-muscular, with a ring of 20 to 22 hooks, each hook with slender blade and ovoid base (Fig. 8); length of blade about 0.01; total length about 0.02.

Excretory system not observed.

DISCUSSION: This monogenean is most similar to the genus *Echinopelma* described by Raecke (1945) from the "margate" fish, probably *Haemulon album,* at Bermuda. It agrees in the character of the haptor and suckers although there is only one, rather than two, pads in the suckers. The testes are both pre- and post-ovarian and the reproductive systems similar except that the organ described as a vagina in *Echinopelma* is rather clearly a vitello-intestinal canal in *Eurysorchis.* The holotype (U. S. N. M. Coll. No. 36926) and sectioned paratype (U. S. N. M. Coll. No. 36927) of *Echinopelma bermudae* were kindly loaned by Allen McIntosh and re-examined with particular regard to the "vagina." This canal arises in the same place as does the vitello-intestinal canal of *Eurysorchis.* Its actual opening to the outside cannot be observed. The sections show that it does proceed close to the body surface, but the critical section is lacking and the last section available shows the distal end of the tube turning away from the surface. We believe that this so-called vagina is actually a vitello-intestinal canal although more material collected from the type host and locality is needed for final determination.

The chief distinction of the genus *Eurysorchis* is the genital atrium armed with a ring of hooks. All other genera in the family Diclidophoridae do not possess a spined atrium. Another distinctive characteristic is the wide dispersal of the testes which are very numerous and extend not only posteriorly to the ovary but also into the haptor. In fact, the majority of the testes are in the haptor.

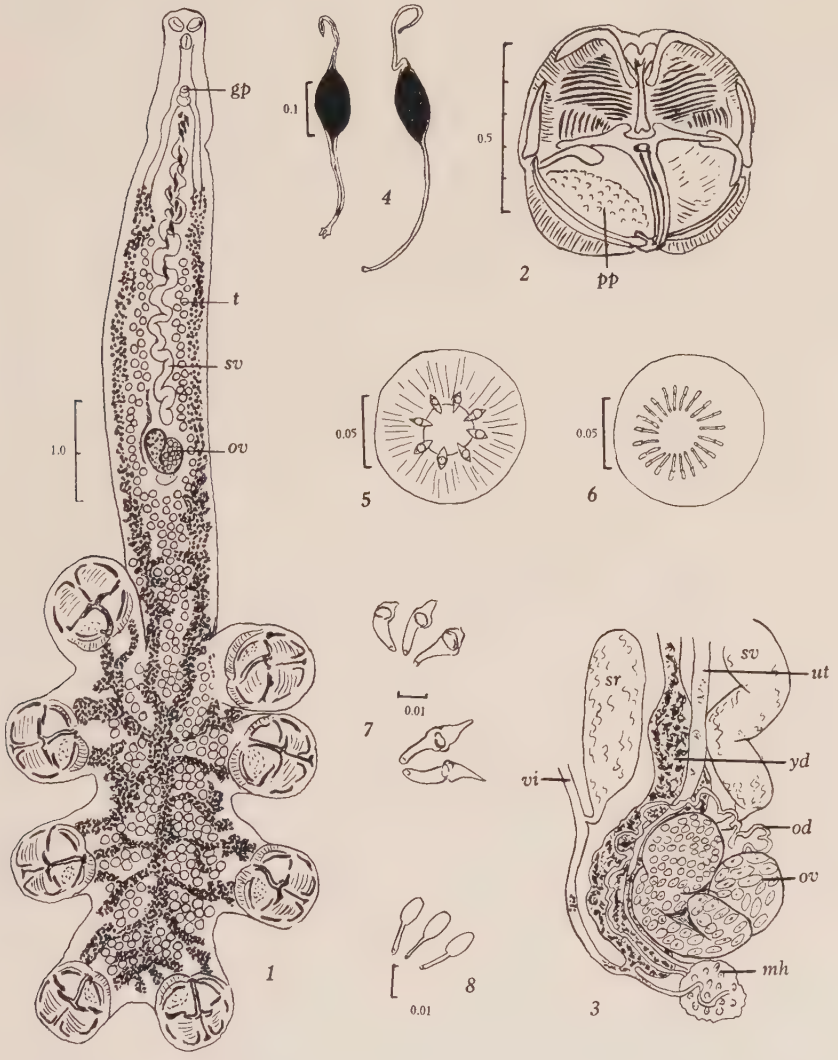
The only other closely related monogenean described is *Cyclobothrium* Cerfontaine, 1895. It differs in that the suckers are non-pedunculated, and without papillated pads, the genital atrium is unspined, and the testes do not extend into the haptor.

SUMMARY

Eurysorchis australis, a new genus and species of monogenetic trematode, is described from the gills of *Seriolella brama,* a nomeid fish of New Zealand. *Eurysorchis* belongs in the family Diclidophoridae, subfamily Cyclocotylinae. Nearest related genera are *Cyclocotyle* and *Echinopelma.*

LITERATURE CITED

RAECKE, MARJORIE JEAN. 1945. A new genus of monogenetic trematode from Bermuda. Trans. Amer. Micros. Soc. 64 (4), 300-305.



All the drawings were done with the aid of a camera lucida except for Fig. 3 which is a diagram.

The value of the projected scale is in millimeters.

Abbreviations: *gp*, genital pore; *mh*, Mehlis gland; *od*, oviduct; *ov*, ovary; *pp*, papillated pad; *sr*, seminal receptacle; *sv*, seminal vesicle; *t*, testes; *ut*, uterus; *vi*, vitello-intestinal canal; *vt*, vitellaria; *yd*. yolk duct.

Fig. 1. Ventral view of *Eurysorchis australis*.
Fig. 2. Haptoral sucker enlarged. The proximal end is at the bottom. Ventral view.
Fig. 3. Diagram of female reproductive system. Ventral view.
Fig. 4. Mature eggs.
Fig. 5. Cirrus. Ventral view.
Fig. 6. Genital atrium. Ventral view.
Fig. 7. Spines from cirrus.
Fig. 8. Spines from genital atrium.

A Note on the Genera *Nematodirus* Ransom, 1907, and *Nematodirella* Yorke and Maplestone, 1926 (Nematoda: Trichostrongylidae)

Frank W. Douvres and John T. Lucker

Animal Disease and Parasite Research Division, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland

In a recently published systematic treatise on the trichostrongylid nematodes, Skrjabin *et al.* (1954) stated (p. 474) that the genera *Nemotodirus* and *Nematodirella* can be distinguished by the following criteria: (1) a perioral crown of denticles present in *Nematodirella* and absent in *Nematodirus*; (2) vulva located in the anterior half of the body in *Nematodirella* and in the posterior half of the body in *Nematodirus*. These authors realized that there had been described in *Nematodirus* certain species which cannot be placed in either genus by strict application of these criteria. One that they commented upon especially, although they did not reallocate it, was *Nematodirus urichi* Cameron, 1935, in which, according to Cameron (1935), a circumoral leaf crown of minute denticles is present, and the vulva is just behind the middle of the body. However, the validity of generic separations depends upon the structure of genotypes, and, so far as the writers are aware, existing characterizations of the respective genera and genotypes support the statement of Skrjabin *et al.*

Nevertheless, because the genotype and commonest included species of *Nematodirus* were described and redescribed before systematists generally appreciated the importance of precise description of cephalic patterns and because experience has shown that uncritical acceptance of the adequacy of existing descriptions of "well-known" species sometimes leads to error, the writers undertook to determine whether typical species of these very closely related genera actually do differ as regards the presence of a "corona radiata." The structure of the genital system of females also was given attention, since Dikmans (1935b) considered atrophy and sterility of the anterior branch of this system characteristic of *Nematodirella* (see also Skrjabin *et al.* 1954. p. 515).

Specimens of *Nematodirus filicollis* (the genotype), *N. spathiger, N. helvetianus, N. abnormalis, N. dromedarii, N. tarandi, N. battus,* and *Nematodirella longispiculata* (the gentoype; from reindeer) and its two subspecies, *N. l. antilocaprae* and *N. l. alcidis,* were examined); all were from the U.S. National Museum Helminthological Collection. Those of *Nematodirus dromedarii,* 3 females and 2 males, were not catalogued under that specific name, but were found in one of two vials in the container of U.S. N. M. No. 2760 (see May, 1920) and undoubtedly are 5 of the 7 specimens upon which May (1920) based this species; the writers are indebted to two of their associates, Allen McIntosh and M. B. Chitwood, for locating this type material.

The anatomy of the female reproductive system and the structure of the head region of both sexes of each of these species and subspecies were studied in totomounted specimens. Males and females of *N. tarandi* and *N. dromedarii* and males of *N. battus* were examined in totomounts only. The cephalic and stomatal characteristics of both sexes of all of the remaining species and subspecies listed were also studied in *en face* preparations (Buhrer, 1949).

OBSERVATIONS

HEAD STRUCTURES: All of the species and subspecies examined *en face* were found to have, regardless of their generic allocation, the same cephalic and stomatal characteristics (Figs. 1-5), which may be described as follows:

Cephalic cuticle inflated. Oral opening circular; bordered and completely encircled by a serrated (denticulate) cuticularized crown. External and slightly caudad to the crown is an internal circle of 6 large papillae (2 internodorsals, 2 internolaterals, 2 internoventrals), the lateral pair being very close to, but slightly cephalad and ventrad to, the amphids. Slightly posterior to this circle and the amphids is an external circle of 8 small papillae, arranged in 4 submedial pairs, the members of each pair adjacent; external and adjacent to each pair, and internal to the margin of the cephalic inflation, is a refractive, apparently cuticularized, undulate, rodlike or slightly crescentic, structure. Buccal cavity (stoma) shallow, its cuticular lining not sharply demarked from the slightly thinner lining of the triradiate eosphageal lumen. Slightly posterior to the anterior tips of the esophageal sectors is a conspicuous dorsal esophageal tooth which normally projects into the ventral ray of the esophageal lumen.

Most of these structures, including the denticulate perioral crown, were also observed in optical sections of totomounts of both male and female specimens of these same species and subspecies and of *N. tarandi*. Whether *N. dromedarii* conforms to this pattern in all respects, and specifically whether a leaf crown is present in this species, was not determined with certainty, owing to the poor condition of the specimens. In certain favorable specimens, *i.e.*, those in which the tips of the esophageal sectors were parted forming "an esophageal funnel," several esophageal teeth, much smaller than the large dorsal one, were observed; whether such esophageal denticles occurred in all of the species listed was not determined.

FEMALE REPRODUCTIVE SYSTEM: This system was invariably aphidelphic. In females of all *Nematodirus* species examined, except *N. dromedarii*, the vulva was in the posterior half of the body and both genital tubes were functional. In *N. dromedarii*, the vulva was, as stated by May (1920), about

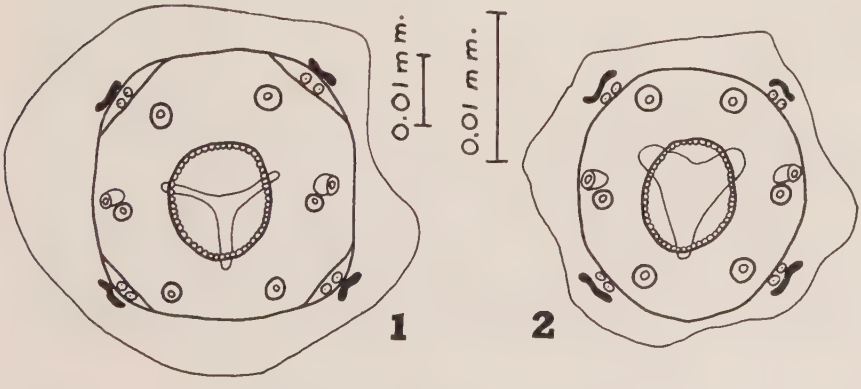


Fig. 1. *Nematodirella longispiculata* (male): Head, *en face*.
Fig. 2. *Nematodirus filicollis* (male): Head, *en face*.

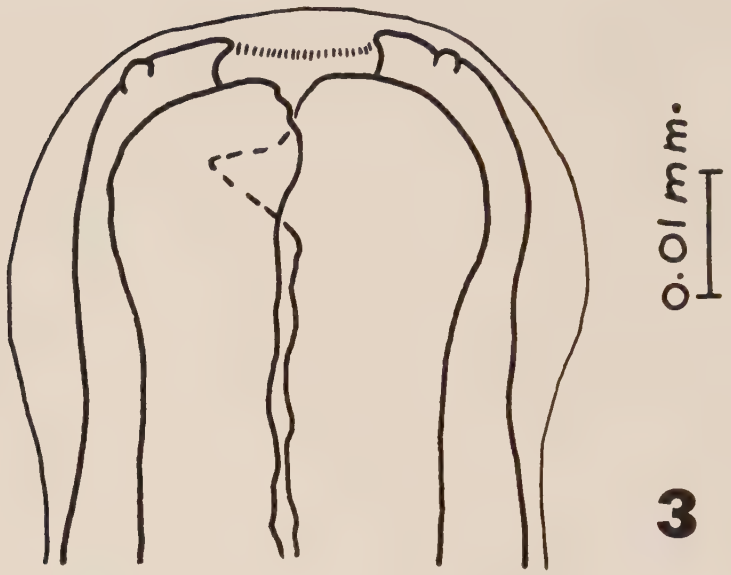


Fig. 3. *Nematodirus helvetianus* (male): Cephalic and stomatal regions in lateral view, showing large dorsal esophageal tooth.

one-third of the body length from the anterior end; the ovijectors were opposed at their origin and, although the poor condition of the specimens greatly hampered observation, the anterior genital tube appeared to lie entirely forward of the vulva and to be atrophied and sterile. In all specimens identified as *Nematodirella*, the vulva was in the anterior half of the body and the anterior genital tube was atrophied and sterile.

Discussion and Conclusions

So far as the writers know, the presence of a denticulate perioral crown has not been reported previously in any of the *Nematodirus* species examined by them. Its presence in both genotypes eliminates it as a character for separation of the two genera under discussion. Reported here for the first time in both genera is the presence of 4 rodlike, or slightly crescentic, essentially cuticular, submedian, cephalic structures which appear to be within the cephalic inflation. Their identity is undetermined. They bear a general resemblance to the 4 "C-shaped" cuticular thickenings recently reported (Douvres, 1956) for the first time in the cephalic inflation of *Ostertagia osteragi*. In published diagnosis for the 2 genera under discussion (May, 1920; Yorke and Maplestone, 1926; Travassos, 1937) and in some specific descriptions, including one (Crofton and Thomas, 1954) published rather recently, the oral opening is stated to be surrounded by 6 cephalic "papillae"; in all species examined *en face* by the writers, 14 cephalic papillae and a pair of lateral sensory organs, which were identified as amphids (Chitwood *et al.*, 1950), rather than papillae, were found to be present.

The second of the two criteria mentioned by Skrjabin *et al.* (*loc. cit.*)

for separation of *Nematodirus* and *Nematodirella, i.e.,* vulva position, is justified by the structure of the genotypes. The structure of these species also justifies characterization of *Nematodirus* and *Nematodirella* as having, respectively, two functional female genital tubes and one functional female genital tube.

Price (1927) stated that the atrophied condition of the anterior uterus of *Nematodirus antilocaprae* [= *Nematodirella longispiculata antilocaprae* (Price, 1927) Dikmans, 1935] relates this species to *N. dromedarii.* He did not state definitely that he had examined specimens of the latter species. In any case, the writers propose for this species the designation *Nematodirella dromedarii* (May, 1920) n. comb., since their own observations have convinced them that the anterior genital tube is atrophied and sterile in specimens considered to be May's types.

Skrjabin *et al.* (*loc. cit.*), who did not accept Dikmans' (1935a) suppression of *Nematodirus skrjabini* Miskewitsch, 1929, as a synonym of *N. tarandi* Hadwen, 1922, expressed the opinion that Hadwen's species belongs in *Nematodirella;* according to them Mitzkewitsch had earlier suggested that its original placement was a mistake. The writers' observation on type and cotype specimens show that the species *tarandi* is correctly placed in *Nematodirus.*

Whether *Nematodirus mauritanicus* Maupas and Seurat, 1912, conforms to the *Nematodirus* pattern in the latter respect appears to be in some doubt. Price (1927) remarked that Maupas and Seurat's (1912) figure of the vulvar region of this species suggests the possibility that one of the uteri may be sterile. Travassos (1937) said definitely that atrophy of the anterior uterine branch has been observed in this species; he mentioned no authority for this statement. As originally described (Maupas and Seurat, 1912), the female reproductive system is opisthodelphic (Chitwood *et al.,* 1950), whereas Raevskaia's (1931) redescription shows that the females she identified as *N. mauritanicus* had an amphidelphic reproductive system; as to sterility of the anterior branch, her paper contains no statement.

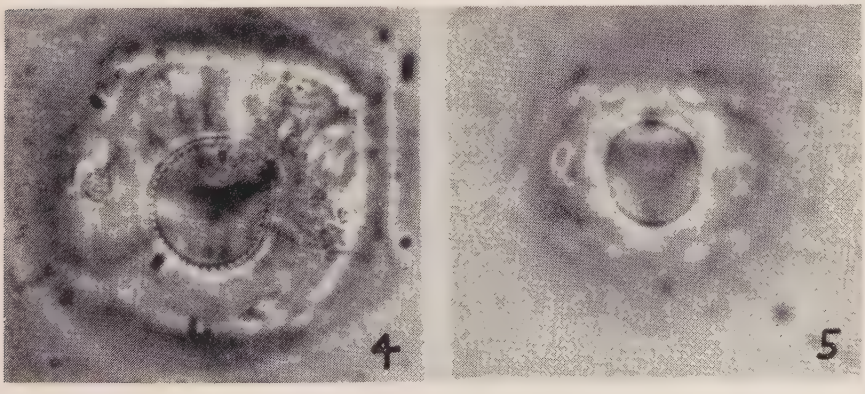


Fig. 4. *Nematodirella longispiculata* (male): Photomicrograph of head, *en face.* (147X).
Fig. 5. *Nematodirus filicollis* (male): Photomicrograph of head, *en face.* (178X)

Summary

Nematodirella and *Nematodirus* cannot be separated on the basis of presence *vesus* absence of a circumoral crown of denticles, since such a crown is present in both sexes of both genotypes. The structure of the genotypes justifies generic separation on the basis of anterior position of the vulva and atrophy and sterility of the anterior female genital tube (*Nematodirella*) *versus* posterior position of the vulva and normal development and functioning of both female genital tubes (*Nematodirus*). As a result of examination of specimens, the new combination *Nematodirella dromedarii* (May, 1920) is proposed, and, contrary to the view of certain previous authors, *Nematodirus tarandi* was found to be correctly allocated generically. Reports in the literature are not in agreement as to the structure of the female reproductive system in *Nematodirus mauritanicus*.

Literature Cited

Buhrer, E. M. 1949. Technique for the beheading and *en face* examination of nematodes and similar animal types. Proc. Helm. Soc. Wash. *16*:3-6.

Cameron, T. W. M. 1935. Studies on the endoparasitic fauna of Trinidad mammals. I. Some parasites of Trinidad deer. Canad. J. Res., Sec. D. *13*:89-96.

Chitwood, B. G., *et al.* 1950. An introduction to Nematology, Sec. I. Anatomy (Revision), 213 pp.

Crofton, H. D., and Thomas, R. J. 1954. A further description of *Nematodirus battus* Crofton and Thomas, 1951. J. Helminth. *28*:119-122.

Dikmans, G. 1935a. A note on the identity of *Nematodirus tarandi* Hadwen, 1922, and *Nematodirus skrjabini* Mitzkewitsch, 1929 (Nematoda:Trichostrongylidae). Proc. Helm. Soc. Wash. *2*, 56.

Dikmans, G. 1935b. A note on Nematodirella (Nematoda:Trichostrongylidae) from three different hosts. Proc. Helm. Soc. Wash. *2*:58-59.

Douvres, F. W. 1956. Morphogenesis of the Parasitic Stages of *Ostertagia ostertagi*, a Nematode Parasite of Cattle. J. Parasitol. *42*:626-635.

Maupas, E. F., and Seurat, L. G. 1912. Sur un nématode de l'intestin grêle du dromadaire. Compt. Rend. Soc. Biol., Paris *73*:628-632.

May, H. G. 1920. Observations on the nematode genus *Nematodirus*, with descriptions of new species. Proc. U. S. Nat. Mus. *58*:577-588.

Price, E. W. 1927. A new nematode, *Nematodirus antilocaprae*, from the pronghorn antelope, with a key to the species of *Nematodirus*. Proc. U. S. Nat. Mus. *71*, Art. 22:1-4.

Raevskaia, Z. A. 1931. Zur Charakteristik der Nematoden der Gattung Nematodirus Ransom 1907. (Versuch einer monographischen Bearbeitung.) Ztschr. Infektionskr. Haustiere *40*:112-136.

Skrjabin, K. I., Shikhobalova, N. P., and Shults, R. S. 1954. Trikhostrongilidy Zhivotnykh i Cheloveka. Trichostrongyloidea of animals and man. (Osnovy Nematodologii, v.3) 683 pp.

Travassos, L. 1937. Revisão da familia Trichostrongylidae Leiper, 1912. Monogr. Inst. Oswaldo Cruz, No. 1, 512 pp.

Yorke, W., and Maplestone, P. A. 1926. The Nematode Parasites of Vertebrates. Churchill, London. 536 pp.

Cross Transmission of Nematodes of Domestic Animals. II. Infection of a Calf with *Hyostrongylus rubidus*, the Red Stomach Worm of Swine

FRANK W. DOUVRES and FRANK G. TROMBA

Animal Disease and Parasite Research Division, Agricultural Research Service, Beltsville, Maryland

In some areas of the United States, it is customary to pasture swine and cattle together or in rotation. These practices have been followed in the belief that little or no cross transmission of parasites occurs between these two species of animals. However, at least six species of nematodes of swine have been reported from cattle (Neveu-Lemaire, 1936), and Kennedy (1954) recently has demonstrated that *Ascaris lumbricoides* from swine can cause granulomatous lesions in the liver of cattle. Therefore, a program of investigation has been initiated to determine whether other swine nematodes can develop in cattle and which species can reach sexual maturity in the bovine host and to obtain further information as to the nature and extent of the injury swine nematodes can cause in cattle. The present report deals with the results of administration to a calf of infective larvae of *Hyostrongylus rubidus* (Hassall and Stiles, 1892) Hall, 1921, and *Oesophagostomum longicaudum* Goodey, 1925; both of these species are pathogenic to swine (Spindler, 1933, and Porter, 1940).

MATERIALS AND METHODS

A parasite-free Holstein bull calf obtained from a local farm within 24 to 48 hours of birth was used as the experimental host. It was raised in an individual stall in a concrete-floored barn, weaned at 8 weeks of age, and then fed alfalfa hay and a grain mixture. Prior to infection, it had a normal and healthy appearance, and had made normal weight gains. When it was 12 weeks old, a single dose of 120,000 infective larvae, approximately half *H. rubidus* and half *O. longicaudum,* was administered to it *per os* by means of a blowpipe attached to a rubber bulb. The larvae had been isolated from sphagnum-moss cultures of the feces of a pig that had been experimentally infected with both species. On two successive days prior to administration of the larvae, feces collected from the calf were examined by a flotation method, using saturated magnesium sulfate solution, and were found to be negative for helminth eggs. Fecal examinations by this method were also made on the 24th, 25th, and 28th days after infection; later on the 28th day, the animal was slaughtered. The gastrointestinal tract was removed and examined for nematodes by the methods described by Porter (1942). The abomasum was washed and scraped and then digested according to the technique outlined by Herlich (1956). The determination of the presence or absence of worms in the various parts of the gastrointestinal tract and estimates of their numbers were based on the examination of standard aliquots of the contents and scrapings and washings of the mucosa and, in the case of the abomasum, the digested material.

RESULTS

On the 24th, 25th, and 28th days after infection, fecal examinations revealed the presence of 582, 180, and 92 eggs per gram, respectively. All eggs found on each examination appeared to be identical with the egg of *H.*

rubidus, as figured by Alicata (1935). No eggs of *O. longicaudum* were present in the feces.

During the first three weeks of the infection, the calf gained an average of 5 lbs. per week and appeared normal. However, commencing on the 24th day, the feces became diarrheic and the animal exhibited a rough coat and appeared sluggish and depressed. Weekly temperatures were normal, except for a marked elevation on the 18th day of infection.

Post-mortem findings revealed the presence in the stomach of 13,000 female and 12,280 male *H. rubidus*, a total of 25,280 worms. This number was roughly equal to 40 percent of the *Hyostrongylus* larvae administered. All specimens in the aliquots examined were sexually mature. The stomach mucosa was edematous and congested, and the worms were distributed over the entire surface.

The contents, as well as the scrapings and washings of the mucosa, of the small and large intestines and the cecum were negative for worms. There was no gross pathological evidence in the large intestine of the presence of *O. longicaudum*.

According to Porter (1940), the prepatent period of *H. rubidus* in swine is 19 to 24 days, with peak egg production, followed by a rapid decline in egg count, occurring 23 to 27 days after infection. The prepatent period in the present experiment was not accurately determined, but can reasonably be assumed to have been earlier than the 24th day, on which the highest egg count was recorded. Porter further stated that maximum numbers of worms, equivalent to 48.3 percent of the larvae administered, were recovered when animals were necropsied 24 to 25 days after infection and in most cases there was an equal sex ratio. Thus in the calf, *H. rubidus* evidently behaved in these respects much as it does in swine. However, in swine, *Hyostrongylus* is generally localized in the fundic region of the stomach, whereas in the test calf, the worms were present over the whole abomasal mucosa.

SUMMARY

As far as the writers are aware, *H. rubidus* has not been previously reported from cattle from either natural or experimental infections. Since a patent infection was obtained in a calf by feeding infective larvae, it is now established that *H. rubidus* can be transmitted from a swine source to cattle. This study would indicate that *O. longicaudum* cannot be transmitted to calves.

LITERATURE CITED

ALICATA, J. E. 1935. Early developmental stages of nematodes occurring in swine. Tech. Bull. (489), U. S. Dept. Agric. 96 pp.

HERLICH, H. 1956. A digestion method for post-mortem recovery of nematodes from ruminants. Proc. Helminth. Soc. Wash. 23: 102-103.

KENNEDY, P. C. 1954. The migrations of the larvae of *Ascaris lumbricoides* in cattle and their relation to eosinophilic granulomas. Cornell Vet. 44: 531-565.

NEVEU-LEMAIRE, M. 1936. Traité d'helminthologie médicale et vétérinaire. Paris. 1514 pp.

PORTER, D. A. 1940. Experimental infections of swine with the red stomach worm, *Hyostrongylus rubidus*. Proc. Helminth. Soc. Wash. 7: 20-27.

———. 1942. Incidence of gastrointestinal nematodes of cattle in the Southeastern United States. Amer. J. Vet. Res. 3: 304-308.

SPINDLER, L. A. 1933. Development of the nodular worm *Oesophagostomum longicaudum* in the pig. Jour. Agric. Res., U. S. Dept. Agric. 46: 531-542.

Occurrence of the Nematodes *Trichostrongylus longispicularis* and *Ostertagia lyrata* in Cattle in Georgia, with Notes on Characteristics of the Specimens

WILLARD W. BECKLUND

Animal Disease and Parasite Research Division, Agricultural Research Service, U. S. Department of Agriculture, Tifton, Georgia, in cooperation with the University of Georgia, College of Agriculture, Agricultural Experiment Station, Coastal Plain Experiment Station, Tifton, Georgia.

During the course of an investigation of the prevalence and distribution of helminth parasites of cattle in Georgia, rather large numbers of specimens of *Trichostrongylus longispicularis* and *Ostertagia lyrata* were recovered by the writer from animals examined at post-mortem, in addition to a variety of other roundworms. Although each of these species was recovered from several animals, neither has heretofore been reported to occur in Georgia and previous records of the occurrence of each elsewhere in the United States are few. In view of the increasing importance of cattle parasitism in the Southeast and the fact that these species were found in some individuals suffering from clinical parasitism, previous reports of their occurrence in this country, their incidence in the cattle examined, and the writer's observations on the structure and size of the specimens recovered are summarized in the present note.

Trichostrongylus longispicularis

So far as the writer is able to ascertain, there are only three previous reports of the occurrence of this species in the United States. Andrews (1934) reported on three males collected from cattle at Jeanerette, Louisiana, and a little later this same author (1935) reported the collection of another specimen from a cow in Florida. Allen, Becklund, and Gilmore (1956) recovered this species in New Mexico from Barbary sheep, an exotic wild breed native to Africa.

In Georgia, to date, the writer has recovered specimens from the contents of the small intestine of 4 of 37 cattle examined by the method described by Porter (1942) for the post-mortem recovery of worm parasites. The hosts were all calves or yearlings and the estimated numbers recovered ranged from 120 to 1,600 per head. The viscera of one of the hosts were obtained at an abattoir; the other viscera were from cattle considered to be suffering from clinical parasitism. From another yearling, Mr. H. H. Vegors collected some specimens which were identified as this species by the writer. Since these 5 infected cattle came from localities in southern, central, and eastern Georgia, this species appears to be widely distributed in this State.

Originally described by Gordon (1933) from a male specimen recovered from a sheep in Australia, *T. longispicularis* was first redescribed by Andrews (1934), who also included some morphologic data in his second note (1935). Although Le Roux (1950) cast some doubt on its validity by pointing out that some males of *T. colubriformis* have a structure resembling that described by Gordon (1933), Sommerville (1956) reported convincing evidence that in size and in the conformation of the spicules and gubernaculum, *T. longispicularis* differs sufficiently from *T. colubriformis* to warrant its rank as a distinct species.

The males collected in Georgia have the morphologic characteristics described by Andrews and by Sommerville; 55 specimens were carefully studied

and their principal measurements are summarized and compared with Sommerville's data (1956), which includes Gordon's and Andrews' measurements, in Table 1. The comparison shows that the Georgia specimens are smaller and have shorter spicules and gubernaculum. These differences may be attributed in part to 18 specimens of what appeared to be a smaller strain, recovered from 1 of the 5 animals. The mean measurements of these 18 specimens were as follows: Body length 4.2 mm., right spicule 149μ, left spicule 158μ, and gubernaculum 79μ. The majority of the 55 males were similar to those described by Andrews in having an inconspicuous hook-like projection near the distal ends of the spicules. Such a projection was indistinct or appeared to be totally absent in 6 specimens. When present, it was more common on the right spicule and was easier to observe from a lateral view. The dorsal ray of 35 male specimens was examined; its terminal branches were symmetrical in all of them.

Ostertagia lyrata

So far as the writer can ascertain, Dikmans (1930) is the only author who has reported the occurrence of this species in the United States; he reported it from cattle in Louisiana.

The writer recovered males which he identified as *O. lyrata* from 12 of the aforementioned 37 cattle; all were found in the abomasum. Of the 12 hosts, 3, which were slaughtered at a local abattoir, harbored from 1 to 40 specimens, whereas 9, which had been suffering from parasitism, harbored from 240 to 10,000 specimens of this species, along with numerous other roundworms. All of the infected cattle came from farms scattered throughout the Coastal Plain area in southern Georgia. Eight were calves or yearlings and 4 were cows; although 2 of the cows had been imported from Florida, they had been maintained on pastures in Georgia for at least 2 years prior to slaughter. Hence, *O. lyrata* apparently is a fairly common cattle parasite in Georgia. Possibly its presence here, and perhaps elsewhere in this country, may have been overlooked heretofore because it usually occurs in association with large numbers of the much better-known species, *O. ostertagi.* The latter species was present in all 12 of the cattle that harbored *O. lyrata;* it was present in large numbers in the 9 animals that had shown symptoms of parasitism.

Originally described from cattle from Austria by Sjöberg (1926), this species was redescribed by Dikmans (1931), who stated that his specimens differed from Sjöberg's description in having spicules which were trifurcated at their distal ends and by having a single dorsal ray. The writer's specimens

TABLE 1.—Measurements of *Trichostrongylus longispicularis* males (in microns except where otherwise indicated)

	Specimens from Georgia Cattle			According to Sommerville (1956)*	
	Number measured	Range	Mean	Range	Mean
Total length (mm.)	53	3.5-6.0	4.6	5.7-7.5	6.2
Length of right spicule	54	136-190	165	168-187	176
Length of left spicule	54	139-197	174	180-200	186
Distance from barb to tip—					
Right spicule	49	31-54	44	45-53	49
Left spicule	49	31-48	41	43-46	44
Length of gubernaculum	55	71-105	87	85-110	94

*Measurements of total length and of spicules include data from Gordon (1933) and Andrews (1935).

agreed morphologically with Dikman's description, which subsequent authors have generally accepted as correctly characterizing the species. Their measurements, however, somewhat exceeded those usually given for the species; the range in length of the body, spicules, and dorsal ray in 45 specimens was 5.1-7.0 mm., 185-251μ, and 95-139μ, respectively.

LITERATURE CITED

ALLEN, REX W., BECKLUND, WILLARD W., and GILMORE, ROY E. 1956. Parasites in the barbary sheep. J. Parasitol. 42 (4, Section 2): 19.

ANDREWS, JOHN S. 1934. *Trichostrongylus longispicularis* collected from cattle in the United States. Proc. Helminth. Soc. Wash. 1: 13.

ANDREWS, JOHN S. 1935. A second report of the occurrence of *Trichostrongylus longispicularis* in cattle in the United States. Proc. Helminth. Soc. Wash. 2: 90.

DIKMANS, GERARD. 1930. [*Ostertagia lyrata* in cattle in Louisiana.] (Abstract of a report before Helminth. Soc. Wash., Oct. 19, 1929) J. Parasitol., 16: 162.

DIKMANS, GERARD. 1931. Two new species of nematode worms of the genus *Ostertagia* from the Virginia deer with a note on *Ostertagia lyrata*. Proc. U. S. Nat. Mus. 79: 1-6, Art. 6.

GORDON, HUGH McL. 1933. Some ovine trichostrongylids reported from Australia for the first time with a description of *Trichostrongylus longispicularis* sp. nov. from a sheep. Austral. Vet. J. 9: 34-37.

LE ROUX, P. L. 1950. *Trichostrongylus leiperi* sp. nov., a parasite of the eland (*Taurotragus oryx*) in northern Rhodesia. J. Helminth. 24: 23-27.

PORTER, DALE A. 1942. Incidence of gastrointestinal nematodes of cattle in the Southeastern United States. Amer. J. Vet. Res. 3: 304-308.

SJÖBERG, AGNES H. 1926. Die bei Rindern im Verdauungstraktus vorkommenden Nematoden. Ihre Diagnostik, klinisch-pathologischen Symptome und Therapie. Wien. Tierärztl. Monatschr. 13: 513-569.

SOMMERVILLE, R. I. 1956. A note on the specific identity of *Trichostrongylus longispicularis* Gordon, 1933. J. Helminth. 30: 21-24.

Feeding and Reproduction of the Nematode *Hemicycliophora parvana**

J. L. RUEHLE AND J. R. CHRISTIE**

Several authors have referred briefly to species of the genus *Hemicycliophora* de Man as being plant parasites, but have given very little information about their habits and nothing about the character and extent of the injury they cause. Thorne (1955) lists 22 species and provides a key for their identification. He notes that these nematodes have been collected from around the roots of plants in many parts of the world, usually in small numbers.

*Florida Agricultural Experiment Station Journal Series, No. 631.

Adapted from a thesis by the senior author presented to the Graduate Council of the University of Florida in partial fulfillment of the requirements for the degree of Master of Science. The research was supported by a fellowship sponsored by the Florida Agricultural Council.

**Fellow in Plant Pathology, College of Agriculture, and Nematologist, Agricultural Experiment Station, respectively, University of Florida.

Steiner (1949) illustrates an unidentified species feeding on the roots of a pine seedling, *Pinus caribaea* Morelet, and alludes to the genus as one composed of sedentary ectoparasites. Tarjan (1952) reports that in greenhouse tests *H. parvana* Tarjan fed and reproduced on the roots of celery. Chitwood and Birchfield (1956) use "sheath nematodes" as a common name for species of this genus and list them among the forms believed to injure plants in Florida.

Sheath nematodes are, in fact, very common in Florida. They are found frequently in soil samples collected from around the roots of various kinds of plants in different parts of the state. When sampling field plots at the Gulf Coast Experiment Station near Bradenton and at the Central Florida Experiment Station near Sanford, investigators frequently encounter sheath nematodes in enormous numbers. These high populations are not, as a rule, widespread, but are restricted to small areas. A given soil sample may contain large numbers while another sample, taken only a few feet away, may contain none or very few.

The sheath nematodes used for the experiments reported herein were collected from a field of the Central Florida Experiment Station at Sanford. They were almost all *H. parvana* but an occasional specimen of some other species may have been included. Because these other forms could be recognized only under a compound microscope, it was impossible to exclude them. The objectives of the experiment were: (a) to determine some of the plants on which *H. parvana* will feed, (b) to determine the manner of feeding, i.e. if this species is strictly an ectoparasite or if it may sometimes penetrate roots and feed on the tissues from within, (c) to determine if the rate of reproduction will account for the high populations encountered and, (d) to determine the manner and extent to which the feeding injures roots.

Feeding Habits

Experiment 1: Seedlings of sweet corn (*Zea mays* L.), common bean (*Phaseolus vulgaris* L.), and hairy indigo (*Indigofera hirsuta* L.) were arranged each with their roots in a Petri dish. The roots were covered with moist sterile soil to which were added about 200 specimens of *H. parvana*. After five days in the laboratory the roots were removed and examined. There was no difficulty in finding the nematodes feeding externally on the roots of bean and corn. They were located slightly back of the root tip at the region of elongation. Frequently several individuals were grouped together feeding apparently in the same puncture and attached with sufficient firmness that they were not easily dislodged. When the roots were fixed and cleared, it could be seen that the heads of the nematodes were slightly embedded in the tissues. The feeding had caused no evidence of a necrotic lesion nor did it appear to have stopped the growth of the tip. No specimen was found feeding on the roots of indigo.

Experiment 2: Six 8-inch clay pots were filled with field soil that was infested with various plant parasitic and other nematodes including a high population of *H. parvana*. Two of these pots were planted with corn, two with beans, and two with indigo. Two weeks later the plants were removed from each pot in turn and the roots thoroughly and vigorously washed to remove all nematodes adhering to the surface. The roots were then macerated with a blender and the nematodes removed from the resulting pulp by the sieving-Baermann technique as outlined by Christie and Perry (1951). The

roots of the beans and of the indigo yielded specimens of a *Pratylenchus* sp., and the roots of the corn yielded both *Pratylenchus* sp. and *Hoplolaimus coronatus*. No specimens of *Hemicycliophora* were recovered from within the roots of any of the plants.

EFFECTS OF DIFFERENT PLANTS ON POPULATION CHANGES

EXPERIMENT 3: Approximately 3,000 cubic centimeters of soil that previously had been fumigated with methyl bromide were placed in each of twelve 8-inch pots. Four of these pots were planted with sweet corn, four with hairy indigo, and four with beans. The indigo was included because field observations at Sanford seemed to indicate that *H. parvana* was feeding and reproducing on this plant, a surmise that proved to be false.

Each pot was inoculated with 200 hand-picked specimens of *H. parvana* at the time of planting. Two and one-half months later another set of 12 pots was filled with fumigated soil, planted and inoculated, exactly duplicating the first set. Five months after the first set was planted the experiment was terminated.

The soil was removed from each pot in turn, thoroughly mixed, and four 150-cc samples taken. The nematodes were removed from each sample, counted, and the mean for the four samples computed. The total population of the pot was computed by multiplying this mean by 20. The nematodes were removed from the soil samples by the sieving-Baermann technique using a 325-mesh sieve. Results are shown in table 1. None of the plants showed stubby-root symptoms or recognizable evidence of necrosis. Apparently the feeding of these nematodes on the roots of bean or corn does not ordinarily devitalize the root tips.

TABLE 1.—Population increase of *H. parvana* from an inoculum of 200 specimens per pot.

Host	Plant	Numbers of Nematodes			
		After 2½ months		After 5 months	
		Per 150 cc of soil[a]	Per pot	Per 150 cc of soil[a]	Per pot
Corn	1	5.25	105	851.25	17025
	2	4.50	90	51.25	1025
	3	30.00	600	597.25	11945
	4	1.50	30	618.00	12360
Bean	1	13.00	260	629.75	12595
	2	26.50	530	333.50	6670
	3	4.75	95	35.75	715
	4	3.00	60	561.50	11630
Indigo	1	0.00	0	0.00	0
	2	0.00	0	0.00	0
	3	0.00	0	1.25	25
	4	0.00	0	0.00	0

[a]Mean of four samples.

EXPERIMENT 4: A field plot experiment was conducted at the Central Florida Experiment Station utilizing an area 6 feet wide by 75 feet long. The soil of this area was quite heavily, though not very uniformly, infested with *Hemicycliophora,* predominantly *H. parvana.* Eleven different plants were grown on this plot, viz., cabbage, celery, cowpea, cucumber, oat, pea, radish, common bean, squash, sweet corn, and turnip. Each kind of plant was grown in a row six feet long running transversely across the plot and the rows were replicated three times.

Each row was sampled at the time of planting, four weeks after planting, and eight weeks after planting. The nematodes were removed from the samples and the specimens of *Hemicycliophora* were counted. The counts showed that, during the eight weeks of the experiment, there may have been a slight increase in the *Hemicycliophora* population around the roots of corn, beans, and turnip but no increase for any of the other plants. None of the increases were statistically significant. Had it been possible to continue the experiment for a longer period of time, populations around the more susceptible plants might have increased enough to result in greater difference between them and the less susceptible ones. In Experiment 3 little or no population increase was obtained at the end of two and one-half months. However, the field-grown plants, or some of them at least, were exposed to a far greater number of nematodes than were the greenhouse-grown plants, and these nematodes had remained largely undisturbed in their natural environment.

Perry (1953) found that, after *Trichodorus*-infested land has been fumigated, these nematodes eventually reappear in the fumigated areas and thereafter reproduce rapidly until the populations become three or four times greater than those of comparable unfumigated areas. The writers suggest that, in the case of both *Trichodorus* and in the present instance with *Hemicycliophora*, fumigation destroyed natural enemies that hold population increase in check. Whatever the correct explanation, it seems obvious that experiments wherein the host plants are grown in fumigated or autoclaved soil are likely to provide a more reliable indication of the potential reproductive capacity of a nematode than experiments conducted under natural conditions in the field.

Conclusions

Hemicycliophora parvana fed readily on the roots of corn and bean but not on the roots of hairy indigo. The nematodes fed externally near the root tip without penetrating the root. Neither corn nor bean developed symptoms indicating that root tips had been devitalized. The feeding had not caused necrotic lesions at the time the roots were examined. The most rapid reproduction occurred on corn and represented an increase of about 1 to 85 in five months. This appears adequate to account for the large numbers of this nematode sometimes found in field samples and would permit rather rapid fluctuation in soil populations.

Literature Cited

Chitwood, B. G. *and* W. Birchfield. 1956. Nematodes; their kinds and characteristics. Fla. State Plant Board v.2, bull. 9, 49 pp.

Christie, J. R. and V. G. Perry. 1951. Removing nematodes from soil. Proc. Helminth. Soc. Wash. 18: 106-108.

Perry, V. G. 1953. Return of nematodes following fumigation of Florida soils. Proc. Fla. State Hort. Soc. 66: 112-114.

Steiner, G. 1949. Plant nematodes the grower should know. Proc. Soil Sci. Soc. Fla. (1942) 4B: 72-117.

Tarjan, A. C. 1952. The nematode genus *Hemicycliophora* de Man, 1921 (Criconematidae) with a description of a new plant-parasitic species. Proc. Helminth. Soc. Wash. 19: 65-77.

Thorne, G. 1955. Fifteen new species of the genus *Hemicycliophora* with an emended description of *H. typica de Man* (Tylenchida: Criconematidae). Proc. Helminth. Soc. Wash. 22: 1-16.

Records of trematodes collected in Turkey with the descriptions of new species in the families Lecithodendriidae and Plagiochiidae*

WILLIAM H. COIL AND ROBERT E. KUNTZ

The Minister of Health of the Turkish Government invited U. S. Naval Medical Research Unit #3, Cairo, to send a field group to Turkey for a period of 2 months during the summer of 1953. This group, consisting of two investigators (a medical zoologist and a parasitologist) and three assistants was designed as the U. S. Naval Medical Reconnaisance Group to Turkey. Studies resulting from this trip are a continuation of geomedical and biological investigations in the Near East with emphasis on the parasites of man and animals, and their host-parasite relationship.

During the course of this trip from the Bosporus to Ankara, a total of 201 vertebrate hosts were examined for helminth parasites. Animals were trapped, shot, and collected with the assistance of local native helpers at 4 representative localities: (1) outskirts of the port city of Istanbul; (2) Sapanca, a small village on the shores of a freshwater lake in the fertile coastal plain a few miles inland from Istanbul; (3) Bolu and Lake Abant, a mountainous area with an altitude of 1200 to 4500 feet; and (4) Ankara and Lake Emir, located in the western part of the elevated plateau of central Turkey at an altitude of 2,000 to 2,500 feet.

This paper is the first of several reports on trematodes taken by the junior author in Turkey.

MATERIALS AND METHODS

The majority of hosts were captured alive and were examined shortly after death. After preparation of skin for identification purposes the viscera were removed from each carcass. Each system was examined separately with the aid of dissecting microscope during and after maceration with small scissors and splinter forceps. Another examaniation was made after tissues had been shaken in stoppered flask or pint fruit jar in several changes of fresh water. Frequently small worms were thus removed from the clean sediment.

All helminths were killed by quick immersion into hot water and then were transferred to dishes with FAA (formalinacetic acid-alcohol) fixative. After 8 to 15 hours, specimens were transferred to procaine tubes and larger vials with 70 per cent alcohol plus 2 per cent glycerine. Harris' haematoxylin and damar were used in preparation of whole mounts. All drawings were made with the aid of a microprojector; finer details were added freehand from either sections or whole mounts.

---

*Studies from the Department of Zoology, University of Nebraska, No. 298. (William H. Coil).

This work supported by Contract Nonr (06), Nr 160-418 of the Office of Naval Research, Department of the Navy.

The authors are indebted to Harry Hoogstrall, Head, Department of Medical Zoology, Naval Medical Research Unit No. 3, Cairo, for assistance in obtaining animals examined and their identifications. The Chicago Natural History Museum has also kindly given assistance in host identifications. B. H. Randall, HM 1, U. S. Navy, gave assistance in examination of hosts, and Dr. Edip Beker, representative of the Turkish Ministry of Health, added greatly to success of trip acting in the energetic capacity of interpreter and as the liaison official.

Present address for Robert E. Kuntz: U. S. Naval Research Unit No. 2, Taipei.

Family Lecithodendriidae Odhner, 1910

Genus *Macyella* Neiland, 1951

M. turkensis, n. sp. (Fig. 1.)

Diagnosis: Small distomes, pyriform to linguiform in shape with cuticular spines extending 4/5 body length. Body 0.58-0.68 long and 0.31-0.37 maximum width in well relaxed specimens. Oral sucker terminal, 0.64-0.84 wide; prepharynx absent. Pharynx 0.34.-0.41 wide; esophagus thin-walled, 0.50-0.74 long. Ceca short 0.162-0.23 long, extending to region am acetabulum, epithelial lining not especially thick. Testes 0.096-0.124 in width, anterior margins situated at level of acetabulum. Cirrus sac large, up to 0.26 long, extending from acetabulum to genital pore located near posterior. Cirrus appears unarmed. Seminal vesicle internal and slightly coiled. Prostate cells present in cirrus sac. Ovary 0.11-0.14 wide, trilobed, located dorsal to acetabulum. Seminal receptacle spherical, 0.043-0.055, located between testes. Vitellaria lateral extending, dorsal to ceca, from region of pharynx to testes. Common vitelline ducts join just anterior to seminal receptacle. Eggs plump, 0.022-0.27 long.

Hosts: Starling, *Sterna vulgaris, Turdus merula.*

Site of infection: Small intestine.

Locality: Lake Abant, Turkey.

Type specimen: Holotype in the Helminthological Collection of the U. S. N. M., No. 38278.

The species described here is clearly different from the genotype, *M. postgonoporus* Neiland, 1951, on the basis of size. The body length of *M.*

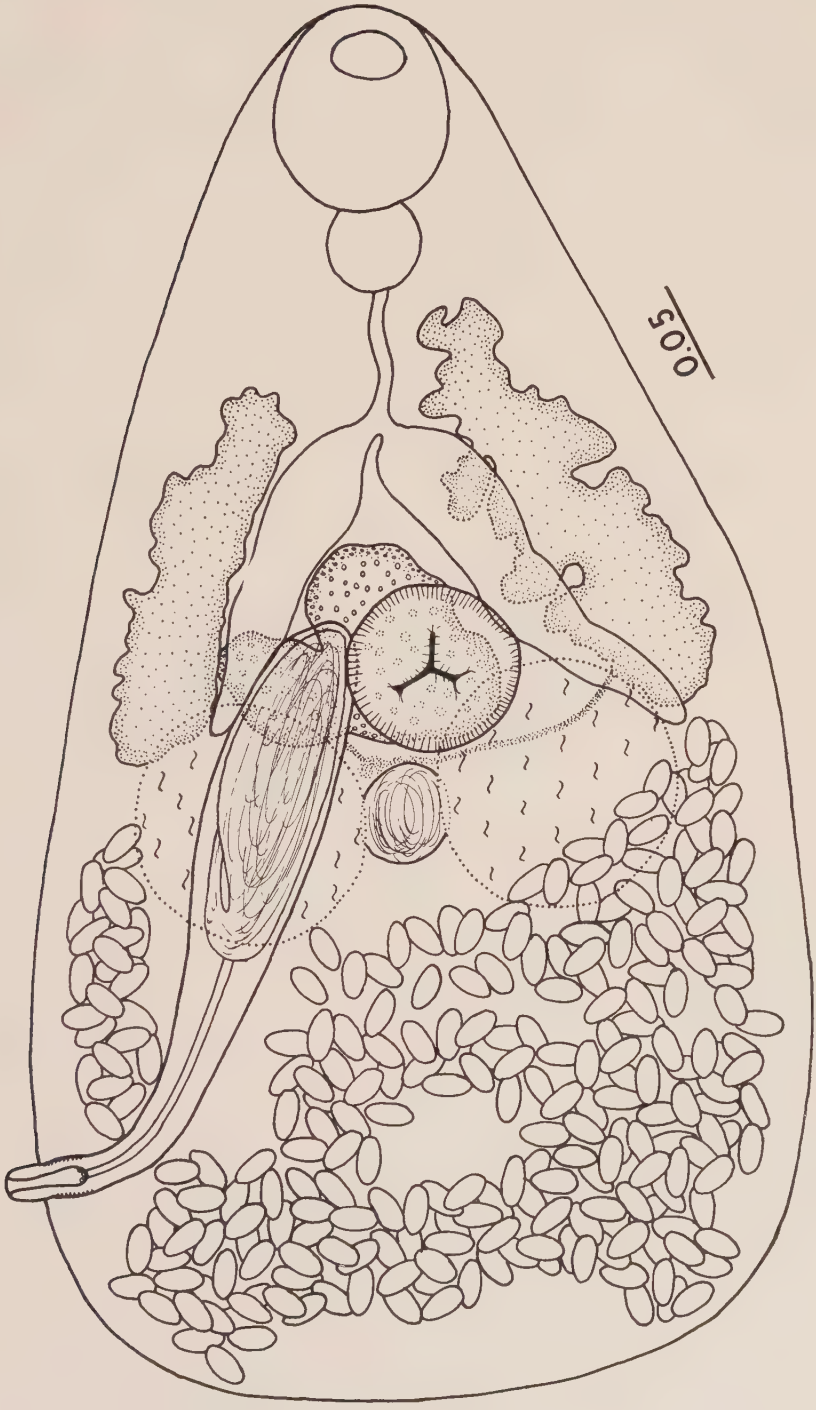
The species described here is clearly different from the genotype, *M. turkensis* is slightly more than half as long, and both the oral sucker and acetabulum are smaller.

Genus *Acanthatrium* Faust, 1919

A. sogandaresi, n. sp. (Fig. 2.)

Diagnosis: Small distomes, almost circular shape in poorly relaxed specimens. Cuticular spines not apparent. Length 0.70-0.81, width 0.69-0.88. Oral sucker terminal, not spherical or ellipsoidal in shape, 0.11-0.16 wide. Prepharynx lacking or extremely short. Pharynx 0.46-0.61 wide. Esophagus very short, 0.030, apparent in sections or lacking. Ceca short, inflated, extending laterad through posterior part of vitelline follicles. Acetabulum 0.12-0.13 wide, located in shallow depression, directed toward anterior. Testes lateral, symmetrical, located just posterior to vitelline follicles. Terminal male genitalia large spherical mass, dorsal and lateral to acetabulum, containing numerous prostate cells and large seminal vesicle of irregular shape. Slightly muscular genital pore opens, opposite to acetabulum, into same shallow depression. Genital atrium slightly muscular with small spines, apparently with irregular disposition. Ovary slightly lateral to acetabulum and overlapping testes. Vitelline follicles clumped in anterior region lateral to oral sucker and pharynx. *Receptaculum seminalis uterinum* voluminous, occupying a position corresponding to that of ovary, but on other side. Uterus filled with numerous eggs; it occupies the posterior half of body. Eggs 0.025-0.27 by 0.013-0.015.

Fig. 1. *Macyella turkensis,* n. sp., ventral aspect.


0.05

HOST: Bat, *Plecotus auritus*.
SITE OF INFECTION: Small intestine.
LOCALITY: Instanbul, Turkey.
TYPE SPECIMEN: Holotype in Helminthological Collection of U. S. N. M., No. 38279.

A. sogandaresi is similar to three other species which either lack an esophagus or possess a short one (*A. molossidis* Martin, 1934, *A. oregonese* Macy, 1939, and *A. pipistrelli* Macy, 1940). The species described here can be differentiated from these species by the peculiar shape of the oral sucker and by the short length of the atrial spines. Cheng (1957) and Sogandares (1956) have published noteworthy discussions of this genus.

Family Plagiorchiidae Luhe, 1910

GENUS *Auridistomum* Stafford, 1905

A. pellucida, n. sp. (Fig. 3)

DIAGNOSIS: Thin or weak distomes, very elongate with no body spines apparent, Body length 3.2-3.7 and width, at level of acetabulum, 0.48-0.58.

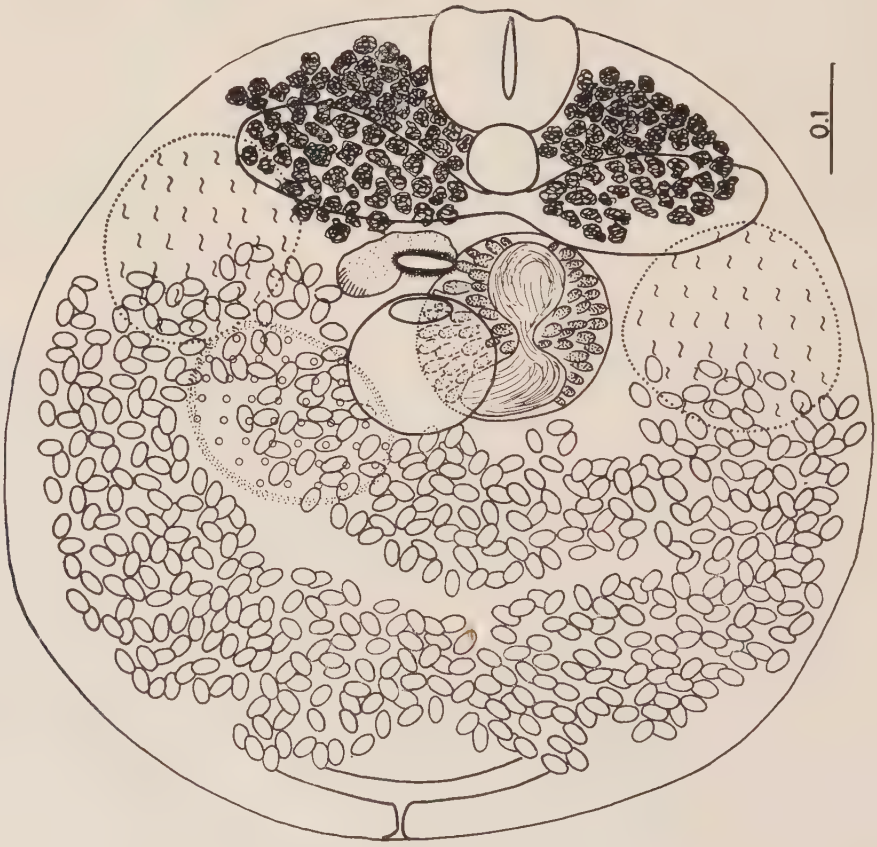


Fig. 2. *Acanthatrium sogandaresi*, n. sp., ventral aspect.

Fig. 3. *Auridistomum pellucida,* n. sp., ventral aspect.

Oral sucker 0.24-0.25 long with four processes extending lateral or an ". . .ear like prominence on each side which consists of dorsal and ventral lobes. . ." (Stunkard, 1924). Prepharynx absent, pharynx 0.095-0.10 wide. Esophagus 0.075-0.14 long. Ceca extend almost to posterior end. Testes 0.096-0.14 wide located in tandem in middle third of body. Cirrus sac 0.36-0.42 long with posterior end in region of acetabulum and containing large seminal vesicle. Cirrus short, pyriform, sparsely armed with slender spines. Prostate cells may be present. Ovary 0.075-0.13 wide, lateral and posterior to acetabulum. Seminal receptacle just posterior to ovary, 0.075-0.15 wide. Vagina thin-walled and ventral to cirrus. Vitelline follicles extend from bifurcation of gut almost to posterior end, along both sides of ceca posterior to testicular region. Eggs 0.68-0.75 long, few in number, located mainly between posterior testis and acetabulum.

HOST: Turtle, *Clemmys caspica rivulata*
SITE OF INFECTION: Small intestine.
LOCALITY: Instanbul, Turkey.
TYPE SPECIMEN: Holotype in the Helminthological Collection of the U. S. N. M. No. 38280.

Two other species appear to be valid members of the genus. (*A. attenuatus* (Stunkard,1924) and *A. thomasi* Dollful, 1950). *A. attenuatus* has a long cirrus sac, a spinose cuticula and vitelline follicles extending from the region of the cirrus sac almost to the posterior end. *A. thomasi* possesses a short cirrus sac, an aspinose cuticula ("Cuticule probablement spinulée, mais à spinules tres caduques," Dollfus, 1950), and vitelline follicles which extend from the region of the acetabulum almost to the posterior end. *A. pellucida* appears to be most similar to *A. thomasi,* but it can be differentiated from the latter species by the distribution of the vitelline follicles which extend to the bifurcation of the ceca.

Macrodera longicollis (Abildgaard, 1788) Lühe, 1909.

HOST: *Natrix natrix.*
SITE OF INFECTION: Stomach.
LOCALITY: Lake Abant, Turkey.
SPECIMEN: Single specimen in the Helminthological Collection, U.S.N.M., No. 38281.

Haplometra cylindracea (Zeder, 1800) Looss, 1899.

HOST: *Rana ridibunda.*
SITE OF INFECTIONS: Lungs.
LOCALITY: Lake Emir, Ankara, Turkey.
SPECIMEN: In Helminthological Collection, U. S. N. M., No. 38282.

Plagiorchis vespertilionis (Müller, 1784) Braun, 1900.

Host: *Rhinolophus ferrum equinum*
Site of infection: Small intestine.
Locality: Lake Emir, Ankara, Turkey.
Specimens: In Helminthological Collection, U. S. N. M., No. 38283.

Family Mesotretidae Poche, 1925

Mesotretus peregrinus (Braun, 1900) Braun, 1900

Host: *Rhinolophus ferrum equinum.*
Site of infection: Small intestine.
Locality: Istanbul, Turkey.
Specimens: In Helminthological Collection, U. S. N. M., No. 38284.

Family Brachylaemidae Joyeux and Foley, 1930

Genus *Brachylaemus* Dujardin, 1843

B. recurvatus Dujardin, 1845

Host: Hedgehog, *Erinaceus europaeus concolor.*
Site of infection: Large and small intestines.
Locality: Sapanca, Turkey.
Specimens: In Helminthological Collection, U. S. N. M., No. 38285.

B. fuscatus (Rudolphi, 1819)

Host: *Sturnis vulgaris.*
Site of infection: Small intestine.
Locality: Lake Emir, Turkey.
Specimens: In Helminthological Collection, U. S. N. M., No. 38286.

Family Dicrocoeliidae Odhner, 1910

Genus *Lutztrema* Travassos, 1941

One complete specimen and several fragments collected, but specific determination was impossible. However, several *Lutztrema* have been reported from this family of birds.

Host: *Turdus merula.*
Site of infection: Small intestine.
Locality: Lake Abant, Turkey.
Specimens: In Helminthological Collection, U. S. N. M., No. 38287.

Family Microphallidae Viana, 1924

Genus *Maritrema Nicoll,* 1907

This species appears to be close to *M. sachalinium,* Schumakowitsch, 1932. The determination is based on size of suckers, disposition of vitelline follicles, shape and position of ovary, and position of genital pore. The usual cuticular spines are absent. It is quite possible the worm was moribund when fixed.

Host: *Turdus merula.*
Site of infection: Small intestine.
Locality: Lake Abant, Turkey.
Specimen: Helminthological Collection, U. S. N. M., No. 38288.

Family Strigeidae Railliet, 1919

GENUS *Tylodelphys* Diesing, 1850

T. excavata (Rud., 1803)

HOST: *Ciconia ciconia.*
SITE OF INFECTION: Small intestine.
LOCALITY: Lake Emir, Ankara, Turkey.
SPECIMENS: Helminthological Collection, U. S. N. M., No. 38289.

LITERATURE CITED

CHENG, T. C., 1957. Studies on the Genus *Acanthatrium* Faust, 1919 (Trematoda: Lecithodendriidae); with the description of two new species. Jour. Parasit. 43: 60-65.

DOLLFUS, R. P., 1950. Trématodes récoltés au Congo Belge par le Professeur Paul Brien (mai-aout 1937). Série V, (1) 135 pp. Ann. Mus. Belg. Congo, C-Dierk R. V.1.

SOGANDARES-BERNAL, F., 1956. Four trematodes from Korean bats with the descriptions of three new species. Jour. Parasit. 42: 200-206.

STUNKARD, H. W. 1925. On some treamtoes from Florida Turtles. Trans. Amer. Micro. Soc. 43: 97-117.

Parasitic Pulmonary Granuloma in the Townsend Mole

W. L. JELLISON and W. J. HADLOW

U. S. Department of Health, Education and Welfare,
Public Health Service, National Institutes of Health,
National Institute of Allergy and Infectious Diseases,
Rocky Mountain Laboratory, Hamilton, Montana

At necropsy of two series of moles, *Scapanus townsendi,* from two well separated areas on the west coast, a conspicuous pulmonary lesion was observed which apparently has not been reported.

This study of the Townsend mole was prompted by a published report of Rector and Rector (1948) on the presence of *Coccidioides immitis* in salivary glands of the Townsend mole collected at Seattle, Washington. Each of the two animals examined by them was reported infected with this fungus. Their diagnosis was based on histologic sections.

In the hope of verifying this observation or further identifying the organism they had observed, we requested two correspondents on the west coast to submit moles for study. Dr. Murray L. Johnson of Tacoma, Washington, and Dr. C. Andresen Hubbard of Tigard, Oregon, have each provided a number of preserved specimens for examination.

Organisms comparable to those illustrated and described by Rector and Rector (1948) or suggestive of *C. immitis* were not observed in histologic sections of salivary glands from 8 moles. However, prominent macroscopic lesions were found in lungs of moles collected from both areas. Five of 10 sent by Dr. Johnson were so affected. These animals came from Puyallup Valley in Pierce County, Shelton in Mason County, and Tacoma in Thurston County, Washington. Eight of 12 moles sent by Dr. Hubbard from near Tigard, Oregon, had similar pulmonary lesions. Moles were collected in November and December, 1955, May 1956, and May 1957.

Lesions varied from a few scattered indistinct white foci to abundant conspicuous, smooth, white nodules, 1 to 2 mm. in diameter, involving possibly one-half of the lung surface (fig. 1). Although many were situated subpleurally, such lesions also were distributed throughout deeper portions of the lungs. When portions of one lung were digested in 2% NaOH solution, a useful method for detecting parasites or fungal cysts in this tissue, these nodules appeared as discrete bodies, 300 microns to 400 microns in diameter.

As seen in variously stained histologic sections, pulmonary nodules possessed morphologic features of well-defined chronic granulomas. Characteristically, they consisted of a necrotic center encircled by a prominent ring composed of a few epithelioid cells and numerous thick collagenous fibers and which was bound by a moderately dense accumulation of lymphocytes, histiocytes, and a few eosinophilic leukocytes (fig. 2). Some central areas contained masses of necrobiotic leukocytes, chiefly eosinophils, whereas others were cavities partially filled with macrophages, necrotic cellular debris, and calcified bodies. In several lungs, tangential and cross-sections of nematode larvae, about 15 t o17 microns in diameter, were identified within such central areas (figs. 3 and 4). Presumably, some calcified bodies were mineralized remnants of these larvae. Although in any given lung most granulomas were at the same stage of development, a few apparently early lesions consisting of focal accumulations of eosinophils, lymphocytes, and histiocytes sometimes were present. Also, an occasional healed lesion was composed almost entirely of dense scar tissue. In one specimen, cross-sections of adult nematodes, about 63 microns in diameter, were found in the lumen of a large branch of a pulmonary vein (fig. 5). Elsewhere, in sections of lung examined, similar adult nematodes or significant microscopic changes were not seen. These macroscopically visible chronic granulomas were interpreted as lesions that had formed around larvae of an unidentified nematode. We have assumed that such larvae and the adult nematodes observed in a pulmonary vein are stages in the life cycle of one species.

The photographs were prepared by Mr. N. J. Kramis.

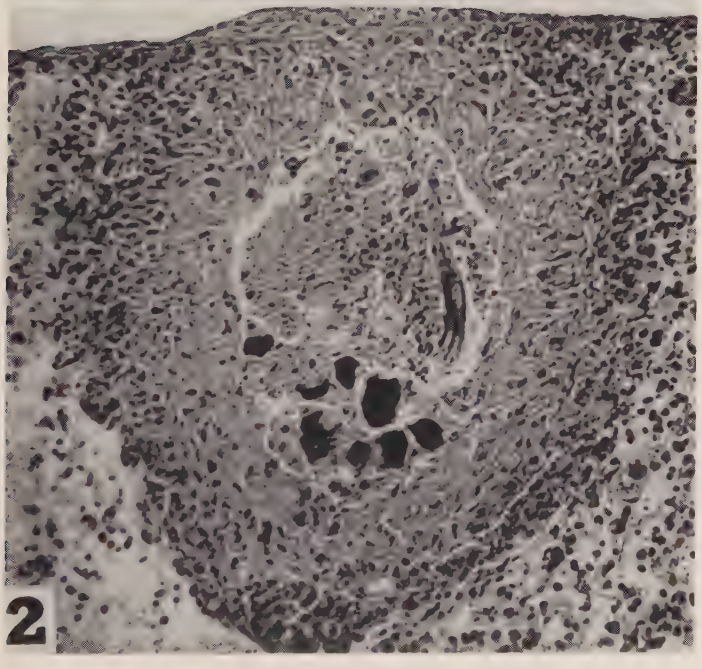
Literature Cited

Rector, L. E. and Rector, E. J. 1948. Coccidioidomycosis in the salivary gland of the Townsend mole. Amr. Jour. Trop. Med. 26:707-709.

Figure 1. Typical macroscopic appearance of subpleural lesions in lungs. This specimen had the most numerous nodules.

Figure 2. Characteristic microscopic features of a subpleural pulmonary nodule. Of note are the calcified bodies and a portion of nematode larva in the necrotic center of the granuloma. Crossmon's triple stain. X 191.

1


2

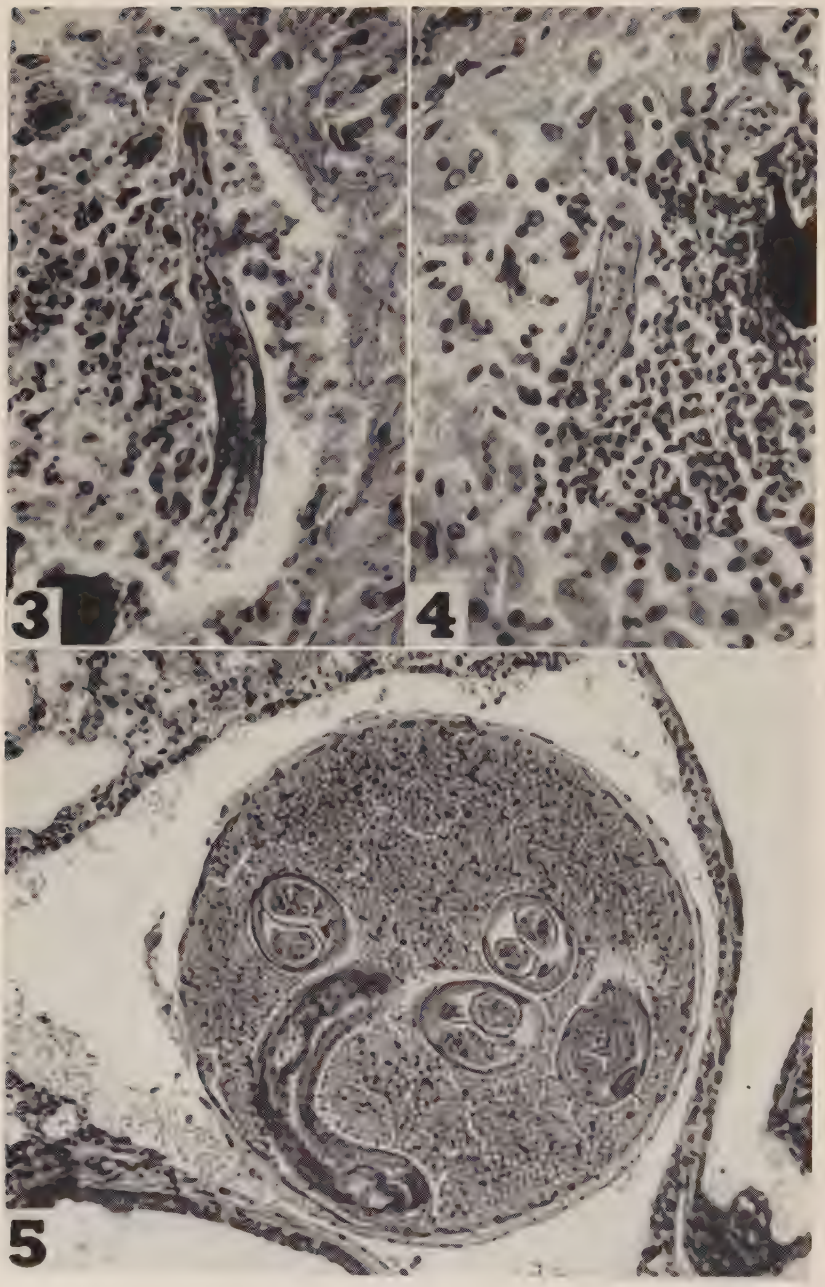


Figure 3. High power view of larva seen in figure 2. Crossmon's triple stain. X 422.

Figure 4. Portion of nematode larvae and leukocytes in center of a granuloma. Hematoxylin and eosin stain. X 422.

Figure 5. Adult nematodes in large branch of a pulmonary vein. Hematoxylin and eosin stain. X 191.

First Report of *Eimeria polita* Pellérdy, 1949, from Swine in the United States of America

ELLIOTT LESSER AND LEONARD REID DAVIS

Regional Animal Disease Research Laboratory, Agricultural Research Service, U. S. Department of Agriculture, Auburn, Alabama

During a survey of protozoan parasites of Landrace, Hampshire, and crossbred swine at the Alabama Agricultural Experiment Station, Auburn, Alabama, coccidial oocysts were encountered which did not resemble those previously reported from pigs in this country. These oocysts were identified as *Eimeria polita* Pellérdy, 1949.

The oocysts in question were detected in fecal samples obtained rectally (a) from each of eight pigs on pasture, and (b) from 16 of 59 pigs examined after they had been in concrete-floored pens about seven days after leaving pasture. Similar oocysts, also identified as *E. polita,* ranging in

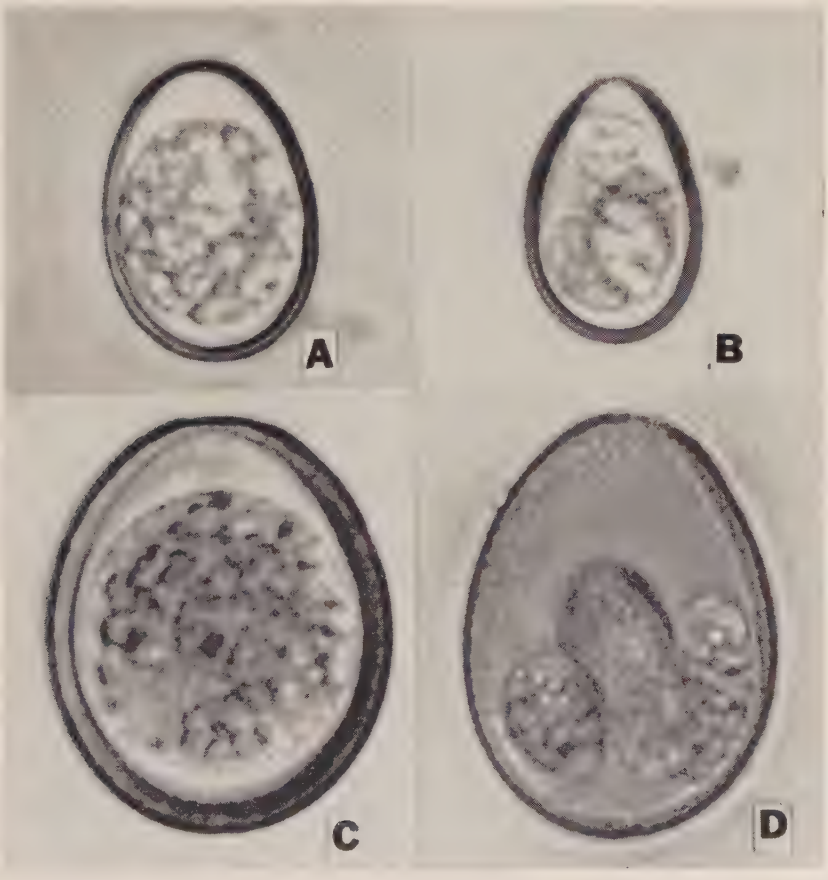


Figure 1. Oocysts of *Eimeria polita* and *E. scabra*; x 1568

A. *E. polita,* unsporulated; B. *E. polita,* sporulated;
C. *E. scabra,* unsporulated; D. *E. scabra,* sporulated.

number up to 91,000 per gram of feces, were encountered in 63 samples of freshly passed droppings from other swine being maintained on pasture.

In our observations, the majority of the oocysts identified as *E. polita* appeared pinkish in color, whereas the remainder were pale yellow. These colors were evident when the oocysts were observed through apochromatic objectives, but were more distinct with achromatic lenses. The wall of the oocyst appeared smooth or, occasionally, slightly roughened; also, a small thin area (possibly a micropyle) was sometimes visible in the wall at the narrow end of the oocyst (Fig. 1, A, B). Measurements of 100 oocysts were made. The size range in microns was 17.2—35.8 by 12.9—24.3; the average size was 23.8 (±3.2) by 17.9 (±2.5). Sporulation was completed in two percent potassium dichromate at room temperature in eight to nine days.

The above description is comparable to that given by Pellérdy (1949) for *E. polita* from swine in Hungary. According to Pellérdy, the "average size of polita oocysts ranges from 23 to 27μ in length and 18 to 21μ in width." His figures were based on measurements of eight oocysts.

Because of the coloration of the oocysts, the thin walled area suggesting a micropyle, and occasional slightly roughened walls, *E. polita* can be differentiated from *E. scabra* (Fig. 1, C, D), which varies in color from yellow to brown, has a distinct micropyle area, and roughened walls. The size ranges of the two species overlap, although *E. scabra* is usually slightly larger. A more detailed comparison of these two species was given by Pellérdy (1949). The oocysts selected for photomicrography (Fig. 1) show the most pronounced differences between the two species.

Literature Cited

Pellérdy, L. 1949. Studies on coccidia occurring in the domestic pig, with the description of a new *Eimeria* species (*Eimeria polita* sp. n.) of that host. Acta Vet. Hungar. 1(2): 101-109.

MEMBERS OF THE HELMINTHOLOGICAL SOCIETY OF WASHINGTON

The following membership list, arranged geographically, includes life, resident, and non-resident members, as defined in Art. 3 of the Constitution (Vol. 13, No. 1 of the Proceedings).

Alabama
Cairns, E. J.
Herlich, H.
Hopper, B. E.
Isenstein, R. S.
Lesser, E.
Porter, D. A.
Price, E. W.
Rohrbacher, G. H., Jr.

Alaska
Dunagan, T. T.
Rausch, R.

Arizona
Reynolds, H. W.

California
Allen, M. W.
Allen, P. H.
Baker, N. F.
DeBonna, Arlette
Dougherty, E. C.
Golden, A. M.
Golden, Thelma S.
Hart, W. H.
Hyneman, D.
Ichikawa, S. T.
Larson J. E.
Lear, B.
Lider, L. A.
Lownsbery, B. F.
Lownsbery, Joyce W.
McBeth, C. W.
Raski, D. J.
Sayama, K.
Sher, S. A.
Tarshis, I. B.
Van Grundy, S. D.
Voge, Marietta
Youngson, C. R.

Canal Zone
Grocott, R. G.

Colorado
Caveness, F. E.
Olsen, O. W.
Rubin, R.
Stabler, R. M.

Connecticut
Miller, P. M.
Penner, L. R.
Pistey, W. R.

Delaware
Fielding, M. J.

District of Columbia
Ballard, Ethyl L.
Barron, C. N.
Bray, R. L.
Briscoe, M. S.
Bruce, J. I., Jr.
Buchheit, J. R.
Durbin, C. G.
Duxbury, R. E.
Gould, D. J.
Harry, H. W.
Hurley, F. J.
Lincicome, D. R.
McMullen, D. B.
Mollari, M.
Needy, C. F.
Ostdiek, J. L.
Reinhard, E. G.
Sarles, M. P.
Sawyer, T. K.
Seitner, P. G.
Slie, Rita B.
Young, Viola M.

Florida
Birchfield, W.
Brothers, S. L.
Chitwood, B. G.
Christie, J. R.
Dery, D. W.
Esser, R. P.
Feldmesser, J.
Hannon, C. I.
Hunter, G. W., III
Kincaid, R. R.
Overman, Amegda J.
Short, R. B.
Sledge, E. B.
Tarjan, A. C.
Thames, W. H., Jr.
Whitton, G. M., Jr.

Georgia
Babero, B. B.
Becklund, W. W.
Bogitsh, B. J.
Denton, J. F.
Good, J. M., Jr.
Hartley, C. F.
Kagan, I. G.
Stewart, T. B.
Vegors, H. H.

Hawaii
Alicata, J. E.
Goto, S.

Illinois
Bauman, P. M.
Elishewitz, H.
Garoian, G.
Jeske, H. A.
Krueger, H. J.
Kruidenier, F. J.
Levine, N. D.
Linford, M. B.
Mankau, R.
Otto, G. F.
Thomas, L. J.
Walton, A. C.

Indiana
Dunagan, T. T.
Ehrenford, F. A.
Hall, J. E.
Phillips, B. P.

Iowa
Hsü, H. F.

Kansas
Ackert, J. E.
Ameel, D. J.
Hansen, M. F.

Kentucky
Chapman, R. A.
Valleau, W. D.

Louisiana
Cordray, D. R.
Cross, H. F.
Hollis, J. P., Jr.
Martin, W. J.
Mayhew, R. L.
Newsom, L. D.
Wehunt, E. J.

Maine
Meyer, M. C.

Maryland
Anastos, G.
Andrews, J. M.
Andrews, J. S.
Bang, F. B.
Borsos, T.
vonBrand, T.
Buhrer, Edna M.
Chitwood, May B.
Clark, G. M.
Clifford, C. M., Jr.
Cobb, Grace S.
Colglazier, M. L.
Coursen, B. W.
Daly, E. F.
DeWitt, W. B.
Diamond, L. S.
Doss, Mildred A.
Douvres, F. W.
Erickson, D. G.
Enzie, F. D.
Evans, A. S.
Farr, Marion M.
Foster, A. O.
Freytag, R. E.
Gardiner, J. L.
Goldberg, A.
Grayson, Margaret A.
Habermann, R. T.
Haley, A. J.
Hawkins, Naomi
Herman, C. M.
Hill, C. H.
Huff, C. G.
Humphrey, Judith M.
Hwang, J. C.
Jacobs, L.
Jahnes, W. G.
Jenkins, W. R.
Johnson, H. W.
Jones, Myrna F.
Kates, K. C.
LaMotte, L. C., Jr.
LaRue, G. R.
Leek, R. G.
Lotze, J. C.
Lucker, J. T.
Luttermoser, G. W.
McIntosh, A.
McLoughlin, D. K.
Newton, W. L.
Olivier, L. J.
Price, D. L.
Read, C. P.
Reardon, Lucy V.
Rohde, R. A.
Rothman, A. H.
Rozeboom, L. E.
Schiller, E. L.
Schindler. A. F.
Schwartz, B.
Shorb, D. A.
Sonnenberg, Bessie
Spindler, L. A.
Spruyt, F. J.
Stirewalt, Margaret A.
Taylor, A. L.
Tromba, F. G.
Turner, J. H.
Underwood, P. C.
Wehr, E. E.
Weinstein, P. P.
Wharton, G. W.
Wilkens, E. H.
Wilson, G. I.
Wright, W. H.
Young, R. T.
Yunker, C. E.

Massachusetts
Boyd, Elizabeth M.
Riser, N. W.

Michigan
Clark, D. T.
Cowan, A. B.
DeGiusti, D.
Dikmans, G.
Wilson, W. D.

Minnesota
Taylor, D. P.

Mississippi
Knight, R. A.

Missouri
Santmyer, P. H.

Montana
Jellison, W. L.
Senger, C. M.

Nebraska
Coil, W. H.
Kelley, G. W., Jr.
Manter, H. W.
Pritchard, Mary H.
Schuster, M. L.

New Jersey
Ballantyne, D. L., Jr.
Goble, F. C.
Haenseler, C. M.
Lynch, J. E.
Tiner, J. D.

New Mexico
Allen, R. W.
Locke, L. N.
Massey, C. L.
Samson, K. S.
Schad, G. A.

New York
Betz, D. O., Jr.
Braun, A. J.
Dropkin, V. H.
Fischthal, J. H.
Friedman, W.
Granek, I.
Ingalls, J. W., Jr.
Mai, W. F.
Spaeth, F. W.
Stoll, N. R.
Stunkard, H. W.
Teodorovic, S.
Thorson, R. E.

North Carolina
Burton, P. R.
Cort, W. W.
Drolsom, P. N.
Garriss, H. R.
Hirschmann, Hedwig
Ruehle, J. L.
Sasser, J. N.

North Dakota
Shumard, R. F.

Ohio
Etges, F. J.
Harwood, P. D.

Oklahoma
Smith, P. E.

Oregon
Ayoub, S. M.
Jensen, H. J.
Macy, R. W.
Smithson, Harriet R.

Pennsylvania
Bloom, J. R.
Gilford, J. H.
Graham, G. L.
Martin, H. M.
Meinkoth, N. A.
Uricchio, W. A.

Puerto Rico
Ayala-Almodovar, A.
Jachowski, L. A., Jr.
Kenworthy, F. T.
Oliver-Gonzales, J.
Peebles, C. R.
Roman, J.
Steiner, G.

South Carolina
Baxter, L. W., Jr.
Graham, T. W.
Hodges, Elizabeth P.
Holdeman, Q. L.

Texas
Atkins, J. G.
Cauthen, G. E.
Drummond, R. O.
Machmer, J. H.
Norton, D. C.
Thomas, H. A.
Turk, R. D.

Utah
Grundmann, A. W.

Vermont
Chute, R. M.

Virginia
Barnard, Maye Hansen
Bartsch, P.
Byrd, M. A.
Cheng, T. C.
Elsea, J. R.
Freund, Frances E.
Hargis, W. J., Jr.
Riggin, G. T., Jr.
Somerville, A. M., Jr.

Washington
Apt, W. J.
Courtney, W. D.

Wisconsin
Perry, V. G.
Standifer, Marie A.
Thorne, G.
White, L. V.

Wyoming
Honess, R. F.

Australia
Sprent, J. F. A.

Austria
Wieser, W.

Belgium
DeConinck, L.

Brazil
Franco, E.
Lordello, L. G. E.

Canada
Anderson, R. C.
Baker, A. D.
Bosher, J. E.
Brown, Georgiana L.
Mountain, W. B.
Orchard, W. R.
Welch, H. E.

Chile
Isaias Tagle, V.

Cuba
Kouri, P.
Pineda, Felicitas

Egypt
Oteifa, B. A.

England
Clapham, Phyllis A.

France
Dollfus, R. Ph.

Germany
Meyl, A. H.

Ghana
Edwards, E. E.
Thomas, J. D.

India
Basir, M. A.
Chauhan, B. S.

Israel
Minz, G.

Japan
Morris, J. A.
Walton, B. C.
Yamaguti, S.
Yokogawa, M.

Liberia
Cook, Alice R.

Malaya
Traub, R.

Mexico
Caballero y C., E.

Pakistan
Timm, R. W.

Panama
Loos, C. A.

Peru
Gonzales-Mugaburu, L.

Philippines
DeJesus, Z.
Yogore, M. G., Jr.

Scotland
Mabbott, T. W.

Switzerland
Baer, J. G.
Dubois, G.

Taiwan
Kuntz, R. E.

Venezuela
Hemerick, G. A.

CONTENTS

PAGE

BECKLUND, WILLARD W. Occurrence of the Nematodes *Trichostrongylus longispicularis* and *Ostertagia lyrata* in Cattle in Georgia, with Notes on Characteristics of the Specimens 55

BOGITSH, BURTON J. *Tetracotyle lepomensis,* n. sp., (Trematoda; Strifeidae) from Fresh-water Fish in Albemarle County Virginia 14

COIL, WILLIAM H. AND ROBERT E. KUNTZ. Records of trematodes collected in Turkey with the descriptions of new species in the families Lecithodendriidae and Plagiochiidae 61

DALY, EDWARD F. A New Dilepidid Cestode, *Paruterina reynoldsi,* from the Southern Crow, *Corvus brachyrhynchos paulus* Howell 34

DERY, DONALD W. A Description of *Maritreminoides raminellae,* n. sp. (Trematoda: Microphallidae) 40

DOUVRES, FRANK W. AND JOHN T. LUCKER. A Note on the Genera *Nematodirus* Ransom, 1907, and *Nematodirella* Yorke and Maplestone, 1926 (Nematoda: Trichostrongylidae) 48

DOUVRES, FRANK W. AND FRANK G. TROMBRA. Cross Transmission of Nematodes of Domestic Animals. II. Infection of a Calf with *Hyostrongylus rubidus,* the Red Stomach Work of Swine 53

GOLDEN, A. MORGAN. *Dolichodorus similis,* (Dolichodorinae), a new species of plant nematode 17

KUNTZ, ROBERT E. *Schistosoma* sp. in Shrews in Lower Egypt 37

JELLISON, W. L. AND W. J. HADLOW. Parasitic Pulmonary Granuloma in the Townsend Mole 67

LESSER, ELLIOTT AND LEONARD REID DAVIS. First Report of *Eimeria polita* Pellérdy, 1949, from Swine in the United States of America 71

MANTER, H. W. AND GAIL WALLING. A New Genus of Monogenetic Trematode (Family Diclidophoridae) from a New Zealand Fish 45

MASSEY, C. L. Four New Species of *Parasitylenchus* (Nematoda) from Scolytid Beetles 26

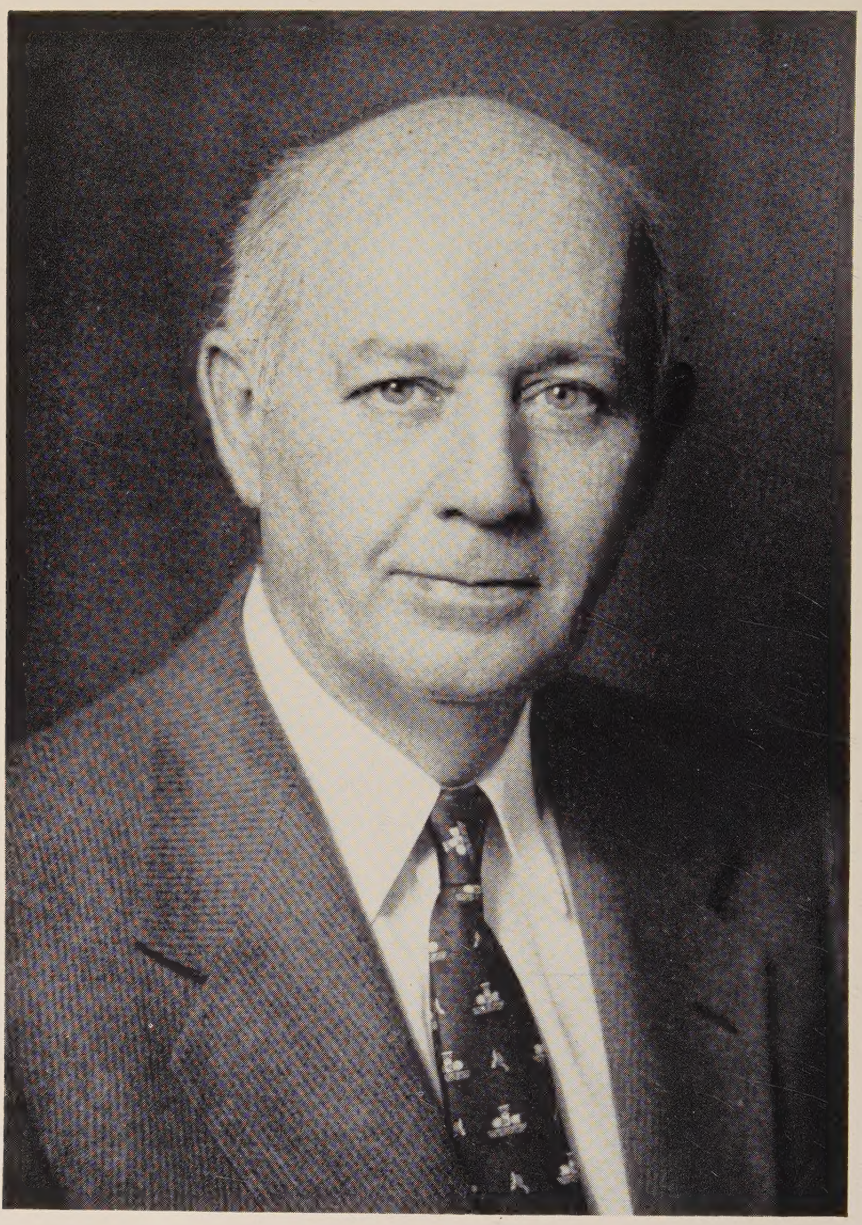
RUEHLE, J. L. AND J. R. CHRISTIE. Feeding and Reproduction of the Nematode *Hemicycliophora parvana* 57

TARJAN, A. C. A New Genus, *Pseudhalenchus* (Tylenchinae: Nematoda), With Descriptions of Two New Species 20

THOMAS, J. D. Three new digenetic trematodes, *Emoleptalea proteropora,* n. sp., (Cephalogonimidae: Cephalogoniminae), *Phyllodistomum symmetrorchis,* n. sp., and *Phyllodistomum ghanense,* n. sp., (Gorgoderidae: Gorgoderinae) from West African freshwater fishes 1

THOMAS, J. D. Two new Digenetic Trematodes, *Heterorchis protopteri,* n. sp. (Fellodistomidae) and *Acanthostomum bagri,* n. sp. (Acanthostomidae: Acanthostominae) from West Africa 8

YUNKER, CONRAD E. The Parasitic Mites of *Myotis lucifugus* (Le Conte) 31



EDWARD GEORGE REINHARD

October 20, 1899—January 29, 1958

Professor and Head of Biology Department, Catholic University of America, Washington, D. C.

Member Helminthological Society of Washington since January 19, 1944, Secretary 1947, Vice President 1948, President 1953,

Executive Committee 1955-56, Editorial Committee 1952-57, Editor 1948-1951.